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Chia Ming's Elements of Dietetics

A SUMMARY OF THE FIRST VOLUME WITH AN INTRODUCTION

The author of the *Yin*[3]*-shih*[2]*-hsü*[1]*-chih*[1] (13269, 9971, 4716, 1783), or The Elements of Dietetics is CHIA[3] MING[2] (1181, 7945). His style name (tzŭ[4], 12324) is CHIA WÊN[2]-TING[3] (12633, 11268). He has also a fancy name, HUA[2] SHAN[1] LAO[3]-JÊN[2] (5005, 9663, 6783, 5624) which means an old man of the Hua Mountain (1). He was a native of the coastal Department of Hai[3]-MING[2] (3767, 8327) in Chekiang province. None of the sources available to me gives dates of his birth or his death. It is stated, however, in the *Hai-ning Chou*[1]*chih*[4] (2444, 1918) or the Annals of the Department of Haining (2), the *Hangchow fu*[3] *chih*[4] (3682, 1918), or the annals of the Prefecture of Hangchow (3), and the *Ssü*[4]*-k'u*[4] *ch'üan*[2] *shu*[1] *tsung*[3] *mu*[4] (10291, 6279, 3176, 10024, 12010, 8080) (4) that he died at the age of 106. This last named collection of books adds that CHIA MING had already attained his 100th year on the accession of T'AI[4]-TSU[3] (10573, 11826), the first emperor of Ming dynasty in A.D. 1368. If this statement is correct (5), CHIA MING's birth date must be A.D. 1268 and his death date A.D. 1374.

Before the downfall of the Yüan House which founded the Mongol dynasty (1289-1367), Chia MING had enjoyed an official position given him as a reward for meritorious service he had rendered to the House. He was a wan[4]-hu[4] (12486, 4959) which

(1) In Chekiang province.
(2) Vol. 12, p. 18 v° and vol. 16, p. 24 r°.
(3) Vol. 141, p. 6 r°.
(4) Vol. 116, p. 29 r°.
(5) I have not been able to find out where the *Ssü-k'u ch'üan-shu tsung-mu* which was compiled in the eighties of the 18th century, got this information.

may be either a military commander of 3000 men upwards to 7000, or a supervisor of maritime transportation, a position which could give him much advantage over other traders who were at that time very numerous, for throughout the Yüan dynasty there was a very prosperous sea-commerce in Hangchow and its neighborhood.

Toward the end of the dynasty, his vast wealth as well as his generosity toward friends and needy people made him an influential and prominent man. Many distinguished scholars and government officials were among his best friends. The very well known statesman and scholar LIU CHI (A.D. 1311-1375) also stayed with CHIA MING as his guest before he started his enviable career under the Emperor T'AI-TSU. But CHIA MING himself was not prominent enough to be mentioned in the Dynastic History of Yüan (6).

There is a story connected with his ominous death. In his 106th year, he had a dream that he was dressed in dark red, riding on a horse and going in a westward direction (7). He met on the road an elegantly dressed woman with a graceful retinue. After he had paid her homage, she said to him, " I have come from the Palace of the moon to attend the funeral of P'êng^{2}-tsu^{3} (8887, 11826) " (8). Thereupon she showed him a grave before them. Upon his wakening, he received from his friend LIU CHI a picture of " Mountain and Sea " (9) with a poem appended to it (10). It happened that in his poem, LIU CHI depicted a mythological land of longevity, then he mentioned the funeral of P'êng-tsu and the news which had come from the goddess of the moon. CHIA MING took all this as an omen of the end of his life. He actually died three days later (11).

CHIA MING's family continued to be prominent for some

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(6) The *Yüan shih.*

(7) The popular Chinese notion was that there was a paradise or Buddhist heaven in the extreme west.

(8) A mythological figure popularly known for his longevity.

(9) In the Chinese tradition, mountain represents longevity, while sea represents blessings or luck.

(10) This poem of LIU CHI can be found in the *Ch'êng^{2}-i^{4} po^{4} Liu^{2} Wên^{2}-ch'êng^{2} kung^{1} wên^{2}-chi^{2}* (766, 5367, 9340, 7270, 12633, 762, 6568, 12633, 906), or Collected Literary Works of the Earl LIU, vol. XI, p. 7 r°.

(11) The story is in the *Hai-ning chou chih,* vol. 16, p. 24.

generations after his death. He had three sons. Two of them, CHIA CHÊ[2] (553) and CHIA YUNG[4]-CHUNG[1] (13449, 2875) became generals in the Ming dynasty. Because of their service to the country, their titles were later made hereditary (12). Another son of his, named CHIA CHIH[2]-CHUNG[1] (1795, 2875), was a generous man like his father. He established a very good library and also a free boarding school for young scholars (13). Some of CHIA MING's grandchildren were also known either as warriors or as literary men (14).

CHIA MING was not an outstanding author or a known man of letters. The *Yin-shih-hsü-chih* is his only known work. But even this work was not very well known. It is not mentioned in any of the major catalogue works compiled in the Yüan and Ming periods.

Explaining how the book was known for the first time, the *Ssŭ-k'u ch'üan-shu-tsung-mu* says that CHIA MING was summoned to the court of the emperor T'AI-TSU and was given an audience with him. When he was asked about his mode of living, the centenarian replied that he paid supreme attention to the kind of diet he took. He presented a draft of *Yin-shih-hsü-chih* to the emperor. The emperor, being very much pleased, gave a banquet in his honor in the building of the Board of Rites.

The *Yin-shih-hsü chih* consists of eight volumes and a short preface by the author himself. Each volume treats a special subject. The eight subjects are : 1. Water and fire; 2. cereals; 3. vegetables; 4. fruits; 5. condiments and dainties; 6. fish; 7. fowl and 8. animals.

The contents of the book were mainly taken from the texts and notes of various works of *Pên*[3]*-ts'ao*[3] (8846, 11634), a group of Chinese pharmacopoeias. CHIA MING himself made, perhaps, very few original contributions (15). Of course, by putting together the scattered statements contained in the various works of *Pên-ts'ao*,he gave us a more handy book on diet and alimentation.

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(12) *Hai-ning chou chih*, vol. 9, p. 35 r° and vol. 16, p. 25 v°.

(13) *Hai-ning chou chih*, vol. 12, p 18 v°; *Hangchow fu chih*, vol. 141, p. 6; *ch'êng-i po Liu Wên-ch'êng kung wên-chi*, vol. 5, p. 4 v°-5 v°.

(14) *Hai-ning chou chih*, vol. 9, p. 35 r° and vol. 12, p. 18 v°-19 r°.

(15) Cf. the *Ssŭ-k'u ch'üan-shu tsung-mu*, vol. 116, p. 29 r° and also the author's own preface.

The *Ssŭ-k'u ch'üan-shu* edition of the *Yin-shih hsü-chih* was based on a copy of it from the home library of one of the editors, CH'ÊNG CHIN-FANG (757, 2070, 3448) (16). We are unable to tell whether the copy from CH'ÊNG's library was printed or in manuscript form. The edition which is available to me is that of HSÜEH^{2}-HAI^{3} LAI^{4}-PIEN^{1} (4839, 3767, 6853, 9178). Apparently the text of this edition is free from corruption. But as no other edition of the *Yin-shih-hsü-chih* is available to me just now, I am unable to make a comparative textual study.

The following pages are a summary of the first volume which is on water and fire. In making this summary I have followed closely the arrangement of the author. Where omissions occur, I have made mention of the fact in my notes.

This summary was made at the suggestion of Dr. GEORGE SARTON, who thinks that CHIA MING's work may be of interest to some readers of *Isis*. He has taken pains to borrow the book from the Library of Congress, and has gladly patronized the work. I am also grateful to him for some valuable suggestions he made in the course of my work. Mrs. DENYS P. MYERS has kindly read my manuscript, to her I owe many thanks.

Vol. I. Water and Fire.

1. Rain-water. It has an agreeable insipid taste. One must not use the water of a heavy rain.

2. Rain-water of the Li^{4}-ch'un^{1} (6954, 2854) festival (17). In case of a woman who is barren, it is good for her and for her husband to take each of them a cup of this water on the day of this festival. This may help them to become more prolific.

3. Rain-water of the plum period (18). Put some such water into soy (19) (or rather the blended substance which is becoming soy) and mix them, the soy becomes prepared sooner than otherwise. If clothes are soaked in such water, they rot. Its vapor

(16) *Ssŭ-k'u ch'üan-shu tsung-mu*, vol. 116, p. 28 v°.

(17) Approximately February 5. It is sometimes called Spring festival in English.

(18) It lasts approximately from the middle of June to the middle of July.

(19) Chinese soy is made from boiled beans, especially soja beans, by a process of long fermentation followed by a prolonged period of immersion in salt and water.

makes people ill and makes things mouldy. It must not be used to make spirit, wine or vinegar or for any washing purposes. If clothes have dark mouldy spots, cook ashes and plum leaves in water, then wash the clothes with such liquid, the dark spots can be removed.

4. Rain-water of the I^4 (5509) period (20). All kinds of insects hibernate when they taste this water. It is good for making anti-insect drugs.

5. Snow water of the La^4 (6667) period (21). It has an agreeable taste. If put in a tightly sealed jar and kept in dark places, it will be still good water even after the lapse of several years. If the seeds of hemp, millet, rice, wheat and pulse are soaked in such water, they can endure some drought, and do not grow worms. It is also good to be used for pickling fruits, for they never will grow insects or worms.

6. Ice. It can only be used to keep things cool. It is not healthy to eat it during summer months, for it is incompatible with the heat of the stomach. One will be ill if he often takes it in summer. People who have taken rhizomes of coplis, teeta, picrorrhiza kurroa, rhubarb, croton tiglium (the croton-oil bean) must take no ice.

7. Dew. Dew on practically any flower is clean. One may use the autumn dew to ferment an excellent kind of spirit called $Ch'iu^1$-lu^4-pai^2 (2302, 7369, 8556) (22). If the dew on the bignonia gets into eyes, it will hurt them.

8. Water found in the hollows of a bamboo fence or a tree. If it has been there a long time already, it may have been made filthy by worms or snakes.

9. Rain-water which drips through the roofs. It should not be used for drinking purposes, for it is very unclean. If one takes it, he may have ulcers on his skin or may contract bowel diseases. The water from the eaves is also very dirty; do not use it for cooking.

10. The hoarfrost of the winter. Sweep it into a jar with

(20) It lasts approximately from Nov. 17 to 22.

(21) It begins approximately with the middle of January. Ordinarily La is the name of the 12th moon of a Chinese lunar year.

(22) Lit. Autumn-dew-white.

a chicken's feather, tightly seal it and then put it in dark places. It can be thus preserved for a long time.

11. Hailstone water. It is unclean. Those who take it will be ill of some kind of pestilence or may even become mad. But when the soy has lost its flavour, put some such water into it, and it recovers its flavour.

12. Fang^{1}-chu^{1} (3435, 2571) water. Mix copper and tin together, 50 % each, and then make a mirror out of such metal which is called Fang-chu. Rub the mirror thus to make it hot, and then turn it toward the moon. One finds later some water on it like the morning dew.

13. Running water which comes from some distant places. Take some such water and put it into a big tub, stir the water energetically for thousands of times. Then take the bubbles which gather on the surface to decoct medicines.

14. Well water. The best kind of well water is that which comes from some distant underearth source. In a densely populated town or market place, dirty water of the drains and gutters may find its way into the well, therefore do not drink such water before boiling it. After it is boiled, the impure carbonate of soda or natron and other filthy substances will sink down to the bottom, then use the clean water on top. If water has become turbid due to rain, pound some kernels of peaches and apricots, throw them into the water together with the juice, then stir the water. After a while it becomes limpid again. Mind that there is no well mud in the water for drinking purposes. If you make a layer of lead at the bottom of a well, the water becomes clean and healthful. It is also very healthful to put some cinnabar or red sulphuret of mercury in a well.

15. Water of various solar terms. A year has 24 solar terms, a term lasts half a moon. The water of the terms Li^{4}-ch'un^{1} (6954, 2854) (23), Ch'ing^{1}-ming^{2} (2188, 7946) (24) is good for making pills, medicinal powders and medicated spirits (i.e., spirits in which drugs have been boiled), for they can be preserved for a long time. During the terms of Ku^{3}-yü^{3} (6229, 13623) (25)

(23) The term lasts approximately from February 5 to 19.
(24) Approximately from April 5 to 19.
(25) Approximately from April 20 to May 4.

the water of Yang-tze River is good for making wine. Drugs and pills become more efficacious if mixed with some water taken at noon time of the 5th day of the 5th moon. If it rains at noon time of the 5th day of the 5th moon, quickly chop down a bamboo, there must be some mysterious water in its stem, drip such water and use it to make medicine. The water of the terms hsiao^{3}-man^{3} (4294, 7622) (26), Mang^{2}-chung^{3} (7655, 2886) (27) and Pai^{2}-lu^{4} (8556, 7369) (28) is unclean. Drugs, wine, vinegar and other provisions prepared with such water spoil easily. People who drink it may get stomach diseases. The first drawing of water out of a well at the fifth watch (i.e., 3 A.M.) of the day of Li^{4}-ch'iu^{1} (6954, 2302) (29) is particularly healthy, for it strengthens the body against fevers, catarrh of the bowels and many other diseases. The water of the terms Han^{2}-lu^{4} (3825, 7369) (30), Tung^{4}-chih^{4} (12246, 1817) (31), Hsiao^{3}-han^{2} (4294, 3825) (32), and Ta^{4}-han^{2} (10470), 3825) (33) is good for soaking or preparing drugs, pills which are to be used for strengthening the body, and it is also good for making medicated spirits. It has the virtues of snow water.

16. Cliff water. Do not use such water if there are black earth, dirty stones or poisonous grass on the cliff. Water of a strong current or a waterfall may cause throat diseases when taken.

17. Water from stone teats. If it weighs heavier than ordinary water, and if after it is boiled, there flow on the surface some flower patterns as those that we find in salt, then it is a healthful kind of water. Water that flows out from a mountain which produces jades and is covered with grass and trees of a glossy colour is also very healthful.

18. Hot springs. It has an acrid flavor. There is sulphur in it. Do not drink it. Whenever it contains arsenic, do not take even a bath in it.

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(26) Approximately from May 21 to June 5.
(27) Approximately from June 6 to 20.
(28) Approximately September 8-22.
(29) Approximately August 7.
(30) Approximately October 8-22.
(31) Approximately December 22 to January 5.
(33) Approximately January 21 to February 4.

19. Sea water. It is unclean for drinking purposes, Lye is very poisonous.

20. Water in old graves. Very poisonous.

21. Water obtained from sharpening a knife (i.e., either the dirty water dropping down from the whetstone on which a knife is being sharpened, or the water in which one washes a knife just sharpened). If one washes his hands in such water, ringworms or some other form of skin diseases may grow on his skin.

22. Liquid of mud slush. Make a ditch on the ground, pour some fresh water into it, stir the water so that it becomes muddy. After a while, take some such water out and clarify it. If one drinks some of it, it dispels melancholy, undoes the effect of some accidental poison or any poison from fish, meat, fruits, vegetables, and mushrooms.

23. Chiang[1] (1210) water. Throw some hot cooked rice into cold water, and leave it for 5 or 6 days, the liquid is called chiang water. It is injurious to health to drink such water. To take it with plum, one will vomit and get cholera. To take it after having got drunk, one may lose his voice. If a woman who is with child takes it, the born baby will be very thin.

24. Chi[1] (822) (34) water. It has a sour and salty flavor. It makes the throat throw up phlegm. A woman may become barren, if she takes much of this water.

25. Water from the vapor of an earthenware pot for steaming rice. It helps medicine to take effect on places where a boil or an ulcer is growing.

26. Hot water. The best kind of hot water is that which is boiled for a long time. Do not use extremely hot water to wash your mouth, for it hurts the teeth. People who have eye diseases, should not use hot water for their bath, for the heat causes uneasiness to the eyes. Hands and feet which are stiff with cold should not be washed in hot water, for the nails may fall off. Do not use copper utensils to heat water, for such water hurts one's voice if one takes it. Do not take water which is half boiled, for it may cause tightness of the stomach due to swelling and hurt your health.

27. When one gets very drunk, or has taken too much fruit,

(34) Chi is a kind of leek.

mix hot boiled and cold water together, put him into it. The water soon has the flavor of wine or fruit.

Both water and earth have much influence on the constitution, character, longevity, voice of the inhabitants of a place.

One must also keep in mind the following warnings :

Do not break the red lines which you may discover in some kind of water.

If the water of a well bubbles and overflows, do not drink it. See if you can find a green stone within thirty paces (length measure of about 5 Chinese feet) of the well and throw it into it, the bubbling up and overflow will thus be stopped.

One must not enter an old and dry well or even an old well, for there may be poisonous gas inside which kills men. These wells are even more dangerous during the summer months. Throw a chicken feather into it, if the feather whirls and does not go down, it shows that there must be poisonous gas. But after pouring into it several bushels of hot vinegar, one may enter such a well. This method holds good in entering an old grave.

Old wells must not be covered, otherwise it may make a person deaf or blind (by its gas ?).

Streams in dark places are unclean. A traveller who drinks out of such streams during the 2nd and the 8th moons of a year, may get malaria or fevers of various kinds and his legs may become weaker.

During the 5th and the 6th moons, there may be sperm of fish and turtles in the stagnant water of a pool. Do not drink it, for it may cause diseases of the bowels.

The water of a vase may be quite poisonous especially when the flower in the vase is winter plum (chimonanthus fragrans).

Do not drink the water which is left overnight in a copper vessel (35).

If one takes the water drops which sometimes appear on a copper vessel, one may have a bad abscess.

To wash one's head either in cold water or in hot slop, one may have a headache.

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(35) The term t'ung^{2}-ch'i^{4} (12285, 1123) includes all wares of copper, brass or bronze.

Do not wash your hands in the water which is not fresh and which has already various colors on its surface, for it is unclean.

Do not take bath in cold water right after you have just recovered from diseases like cholera, malarial fever, etc., for the cold water may hurt your heart.

To have a bath in cold water when the weather is very hot, one may catch cold.

To take a cold bath while sweating, one may get rheumatism.

A woman who has just given birth to a child must not take a bath in places where there is a draft, otherwise she may become fatally ill.

If one drinks cold water while taking wine or spirits (36), one's hands may become shaky. If one drinks cold tea after having taken wine or spirits, one may get a mania for such beverages.

If one drinks water and then goes to bed immediately, one may have a mania for water.

Do not use cold water to wash your feet after you have travelled a long journey on foot in summer.

Do not use hot water to wash your feet, after you have travelled a long journey on foot in winter.

Children who drink water out of a gourd may stammer.

In the brief section on fire, the author says at the beginning, that trees are not to be hewn down at any time of the year as you like, but each kind of tree must be hewed down only at a proper season. Then he mentions some kinds of trees and also the seasons during which they may be cut down. After this he discusses more particularly the fire of several kinds of fuel.

1. The fire of mulberry-wood. It is good for cooking nourishing medicines. But it must not be used to cook pork and eels, or to broil the ai[4] plants (37) for the plants may hurt your skin, when you use them.

2. The ash fire of a cooking-stove must not be used to burn the incense which will be used for worshipping spirits.

3. The fire of the ai plants. To light a stick of the ai plant,

(36) The old Chinese habit was to warm up their wine or spirits before they drank it.

(37) For the use of this plant, see below.

one must use the fire taken from boring the wood of sophora japonica. One may also use the fire of some hemp-seed oil or of a candle to light it. An ai-stick flame thus obtained can be used to heal an inflamed boil without causing pain to the patient.

The fire of the following kinds of wood are not healthy : pine wood (pinus), cypress wood (cypressus funebris), mulberry wood (morus alba), cudrania triloba, jujube wood (zizyphus vulgaris), wood of the various kinds of orange trees, elm wood (ulmus campestris and u. macrocarpa, hance).

(Harvard-Yenching Institute.) T. T. CHANG.

Giovanni da Fontana again

Since Professor ALEXANDER BIRKENMAJER in his recent article on GIOVANNI DA FONTANA (" Zur Lebensgeschichte und wissenschaftlichen Tätigkeit von Giovanni Fontana, 1395?-1455? " *Isis*, 17, 34-53, 1932) has taken issue with me on one or two points, perhaps I should explain and defend my positions.

I cannot agree with BIRKENMAJER (p. 36, note 10) anent the passage, " ... in Utino die ultimo Februarii per IOHANNEM FONTANAM VENETUM physicum medicum eodem in loco salariatum," that " THORNDIKE... bezog fälschlich das ' eodem in loco ' auf Udine, anstatt an das unmittelbar vorangehende ' Venetum.' " *Venetum* is an adjective, not a noun, and cannot be the antecedent of *eodem in loco*, which must refer to the preceding noun, *Utino*. The meaning therefore is that GIOVANNI DA FONTANA is a Venetian physician but that he draws salary as municipal physician in Udine. BIRKENMAJER himself at p. 48, note 55, quotes another passage which indicates that FONTANA practised medicine at Udine. Therefore my statement in *Isis*, 14, 221, that FONTANA was municipal physician at Udine is correct, while my allusion to him in *Isis*, 15, 37, as " a salaried physician of Venice " is misleading.

When at p. 35 BIRKENMAJER writes, " so müssen wir den Versuch THORNDIKES als wenig glücklich bezeichnen, ihn (i.e. FONTANA) mit einem Dominikaner gleichen Namens und Vornamens zu identifizieren, welcher in dem bekannten Werke von QUETIF-ECHARD erwähnt wird, welcher aber aus Piacenza stammte und dortselbst tätig war," he seems to have misapprehended my intention. I of course do not have the faintest notion that GIOVANNI DA FONTANA of Venice was either a Dominican or of Piacenza. I merely wished to suggest that the notice in QUETIF and ECHARD might be the result of a confusion on their part owing to the fact that FONTANA's *Liber de omnibus rebus naturalibus* was printed

under the name of POMPONIUS AZALUS of Piacenza, and that there may have been no Dominican of Piacenza named GIOVANNI DA FONTANA at all. However, it may be noted that a LUDOVICUS DE FONTANA of Piacenza in 1434 received the licentiate in canon law at Padua : see ZONTO et BROTTO, *Acta graduum academicorum gymnasii Patavini*, Padua, 1922, No. 985. Thus the family name, FONTANA, at least, was associated with Piacenza as well as with Venice. The same records of the university of Padua show that among those present on May 26, 1417, at examinations for the licentiate and doctorate was " master JOHN, son of MICHAEL DE LA FONTANA of Venice " (*Ibid.*, No. 418). This indicates that our GIOVANNI DA FONTANA was a Venetian by birth. His own licentiate and doctorate in arts are dated June 18 and 19, 1418 (*Ibid.*, Nos. 471-472). From July 7, 1418 to April 6, 1419, his name appears frequently as rector of the " artists." On May 17, 1421, came his examination for the licentiate in medicine (*Ibid.*, No. 554).

LYNN THORNDIKE.

Browne's "Hydriotaphia" with a reference to adipocere (*)

Sir THOMAS BROWNE's "Hydriotaphia, Urne-Buriall, or, a Brief Discourse of the Sepulchrall Urnes Lately Found in Norfolk" has for a long time occupied an important position among the writings of the seventeenth century. It was first printed in 1658 and GEOFFREY KEYNES points out that it was written probably in 1656 (1). As an example of seventeenth century prose it is excellent and a few of its references to natural phenomena are worth quoting as indicative of ideas prevalent at that time, although for a really instructive and amusing account of BROWNE's knowledge of science and history one should read his "Pseudodoxia Epidemica or Enquiries into very many received tenents and commonly presumed Truths, which examined prove but Vulgar and Common Errors."

The principal topic of "Hydriotaphia" is the discovery of a number of burial urns at Walsingham in Norfolk. Around his subject, however, BROWNE weaves a fascinating discussion on the disposal of the body after death as practised in various countries by different sects during different periods of history, on the history of cremation and urn burial, on notable monuments, urns and relics, on burial customs, and on classical ideas regarding a life after death. He closes with a chapter on immortality which, in the words of Professor NEILSON (2), "places BROWNE in the first rank of writers of English prose."

(*) Certain passages of some historical interest to chemistry in Sir THOMAS BROWNE's "Hydriotaphia" (1658) are quoted, and a plea is made for the recognition of BROWNE, instead of FOURCROY, as the first discoverer of adipocere.

(1) KEYNES, "The Works of Sir Thomas Browne." Vol. 4. FABER and GWYER Ltd., London, 1929, p. VII.

(2) ELIOT, "The Harvard Classics." Vol. 3. COLLIER and SON, New York, 1909, p. 262.

An interesting passage occurs regarding methods for the disposal of the body as practised by the followers of certain of the Greek philosophers. Since the idea of a primordial element formed an integral part of some of the systems of philosophy it is perhaps not surprising to learn that disciples should adopt that method for disposing of the body after death which appeared most favourable to a rapid resolution into whichever " element " was considered to be the primal matter.

On this subject BROWNE writes as follows (3).

" Now as all customes were founded upon some bottome of Reason, so there wanted not grounds for this; according to severall apprehensions of the most rationall dissolution. Some being of the opinion of THALES, that water was the originall of all things, thought it most equall to submit unto the principle of putrefaction, and conclude in a moist relentment. Others conceived it most natural to end in fire, as due unto the master principle in the composition, according to the doctrine of HERACLITUS. And therefore heaped up large piles, more actively to waft them toward that Element, whereby they also declined a visible degeneration into worms, and left a lasting parcell of their composition.

Some apprehended a purifying virtue in fire, refining the grosser commixture. and firing out the Æthereall particles so deeply immersed in it. And such as by tradition or rationall conjecture held any hint of the finall pyre of all things; or that this Element at last must be too hard for all the rest; might conceive most naturally of the fiery dissolution."

The idea of density as dependent on both mass and volume and the recognition that many substances show an apparent loss in weight on burning find expression in the following passage regarding cremation (4) :

" How the bulk of a man should sink into so few pounds of bones and ashes, may seem strange unto any who considers not

(3) " Hydriotaphia, Urne-Buriall, or, A Discourse of the Sepulchrall Urnes lately found in Norfolk. Together with The Garden of Cyrus, or the Quincunciall, Lozenge, or Net-work Plantations of the Ancients, Artificially, Naturally, Mystically Considered. With Sundry Observations. By THOMAS BROWNE D. of Physick. London, Printed for Hen. Brome at the Signe of the Gun in Ivy-Lane. 1658." P. 5.

(4) " Hydriotaphia, etc. 1658." P. 43.

its constitution, and how slender a masse will remain upon an open and urging fire of the carnall composition. Even bones themselves reduced into ashes, do abate a notable proportion. And consisting much of a volatile salt, when that is fired out, make a light kind of cinders. Although their bulk be disproportionable to their weight, when the heavy principle of Salt is fired out, and the Earth almost only remaineth; Observable in sallow, which makes more Ashes then Oake; and discovers the common fraud of selling Ashes by measure, and not by ponderation."

According to L'EMERY (5) there were five principles of chemistry; three active, namely, spirit or mercury, oil or sulphur, and salt, and two passive, namely, water or phlegm, and earth or *teste morte*.

The seventeenth century opinion that fire causes volatile or " attenuable " parts to be " fired out " or " fly " away from fire is emphasized in a later paragraph (6).

" From animals are drawn good burning lights, and good medicines against burning; Though the seminall humour seems of a contrary nature to fire, yet the body compleated proves a combustible lump, wherein fire findes flame even from bones, and some fuell almost from all parts. Though the Metropolis" (marginal note—" The brain. HIPPOCRATES ") " " of humidity seems least disposed unto it, which might render the sculls of these Urnes lesse burned then other bones. But all flies or sinks before fire almost in all bodies : When the common ligament is dissolved, the attenuable parts ascend, the rest subside in coal, calx or ashes."

It is not surprising that confused explanations such as these of the phenomenon of combustion should lead in the course of the next half century to the development of such an erroneous idea as that of phlogiston.

Of particular interest historically is a reference, undoubtedly to human adipocere, which apparently has escaped the attention of organic chemists and of the compilers of chemical dictionaries

(5) L'EMERY, " Cours de Chymie," ninth edition. ESTIENNE MICHALLET, Paris, 1697, p. 2.

(6) " Hydriotaphia, etc. 1658." P. 45.

although it has been noted in at least two editions of " Hydriotaphia." (7) (8).

The name adipocere is due to FOURCROY and he is usually credited with the first observations on this substance.

Thus, HENRY WATTS (9) defines adipocere as, " A fatty substance produced in the decomposition of animal substances in moist ground; first found by FOURCROY in the *Cimetière des Innocens* at Paris," and JULIUS LEWKOWITSCH (10) refers to it as, " A peculiar waxy-looking substance, first observed by FOURCROY in 1786, when the *Cimetière des Innocents* at Paris was cleaned out."

An indefinite reference to earlier observations occurs in URE's Dictionary of Chemistry (11) in the following paragraph.

" The attention of chemists has been much excited by the spontaneous conversion of animal matter into a substance considerably resembling spermaceti. The fact has long been well known, and is said to have been mentioned in the works of Lord BACON, though I have not seen the passage. On the occasion of the removal of a very great number of human bodies from the ancient burying-place des Innocens at Paris, facts of this nature were observed in the most striking manner. FOURCROY may be called the scientific discoverer of this peculiar matter, as well as the saponaceous ammoniacal substance contained in bodies abandoned to spontaneous destruction in large masses. This chemist read a memoir on the subject in the year 1789 to the Royal Academy of Sciences, from which I shall abstract the general contents." Then follows a graphic description of the opening of the graves in the " burying-place des Innocens " at

(7) MURISON, " Sir Thomas Browne. Hydriotaphia." The University Press, Cambridge, 1922, p. 94.

(8) WILKIN, " The Works of Sir Thomas Browne," 1836. (Referred to by MURISON, *loc. cit.*) ; WILKIN, " The Works of Sir Thomas Browne." Vol. 3. G. BELL and Sons, Ltd., London, 1910, p. 31.

(9) MUIR and MORLEY, " WATTS' Dictionary of Chemistry." Vol. 1. LONGMANS, GREEN, and Co., London, 1918, p. 64.

(10) THORPE, " A Dictionary of Applied Chemistry." Vol. 1. LONGMANS, GREEN, and Co., London, 1916, p. 48.

(11) URE, " A Dictionary of Chemistry," third edition. Printed for THOMAS TEGG, 73, Cheapside; T. HURST and Co., St. Paul's Churchyard; S. HIGHLEY, and T. and G. UNDERWOOD, Fleet-Street; SIMPKIN and MARSHALL, Stationer's Court : Also R. GRIFFIN and Co., Glasgow; and J. CUMMING, Dublin. London, 1828, p. 103.

which FOURCROY was an official observer, together with an account of the condition of the bodies, and subsequent experiments by various workers in an attempt to determine the nature of adipocere and the conditions for its formation.

The reference to Lord BACON (1561-1626) fixes a time at the end of the sixteenth or the beginning of the seventeenth century as producing the first recorded observations on adipocere. The reference however is vague and apparently was not confirmed.

The unmistakable reference to adipocere in " Hydriotaphia " occurs at the end of the following quotation (12) which is given at some length because of its quaint terminology and admixture of fact and superstition.

" To be gnaw'd out of our graves, to have our sculs made drinking-bowls, and our bones turned into Pipes, to delight and sport our Enemies, are Tragicall abominations, escaped in burning Burials.

Urnall enterrments, and burnt Reliques lye not in fear of worms, or to be an heritage for Serpents; In carnall sepulture, corruptions seem peculiar unto parts, and some speak of snakes out of the spinall marrow. But while we suppose common wormes in graves, 'tis not easie to finde any there; few in Church-yards above a foot deep, fewer or none in Churches, though in fresh decayed bodies. Teeth, bones, and hair, give the most lasting defiance to corruption. In an Hydropicall body ten years buried in a Church-yard, we met with a fat concretion, where the nitre of the Earth, and the salt and lixivious liquor of the body, had coagulated large lumps of fat, into the consistence of the hardest castle-soap; whereof part remaineth with us."

Since " castle-soap " was an alternative name for " castile soap " (13) the comparison is very good as I have verified by the examination of some human adipocere which was the property of the late Dr. R. F. RUTTAN and is now in the Chemical Museum of this University.

The explanation suggested for the formation of adipocere from an " Hydropicall body " by the action on the fat of the " nitre

(12) " Hydriotaphia, etc. 1658." P. 48.

(13) SAMUEL JOHNSON, " Dictionary." Edition of 1852, p. 91; " A New English Dictionary on Historical Principles." Vol. 2. The Clarendon Press. Oxford, 1893. (Castile soap), p. 161.

of the Earth, and the salt and lixivious liquor of the body " is either a remarkably good guess or is based on scientific observation and possibly on crude experiments. In this connection it must be remembered that Sir THOMAS BROWNE not only was an eminent writer but was also a very successful physician, and many of the men who were prominent in the development of chemistry during the seventeenth century were members of his profession.

Compare BROWNE's explanation with the following passage from the work of RUTTAN and MARSHALL (14) in 1916.

" Adipocere is the residue of the pre-existing fats of animals. It is composed almost entirely of insoluble fatty acids left after slow hydrolysis of the fats in the wet ground. The protein has entirely disappeared and the glycerol, soaps, etc., resulting from hydrolysis, are carried away in aqueous solution. The insoluble hydroxy-stearic acids which are so characteristic of adipocere are derived from a portion of the oleic acid in the original fat by hydration."

BROWNE was correct in assuming that it was the fat of the body which was the origin of the adipocere. His reference to an " Hydropicall body " (i.e. affected with dropsy which involves a collection of simple serous fluid in the cavities or tissues of the body (15)) and to " lixivious liquors " indicates that he recognised the necessity for the presence of water. It would perhaps be stretching the case too far to suggest that the use of the adjective " lixivious " implies a knowledge that lixiviation or the removal of saline products (in this case, soaps) by water, was an accompanying phenomenon.

" Nitre " and " salt " we know now are not necessary to the formation of adipocere. Certain early experiments (16) indicated, however, that hydrolysis was more rapid and satisfactory in the presence of nitric acid. If BROWNE carried out any rough experiments to determine the mode of formation of adipocere he may

(14) RUTTAN and MARSHALL, Proc. Soc. Biol. Chem., *J. Biol. Chem.* 24, XII (1916); *Chemical Abstracts*, 10, 2900 (Nov. 20, 1916).

(15) " The Encyclopædia Britannica," eleventh edition. Vol. 8, The University Press, Cambridge, 1910. (Dropsy), p. 590; " The Century Dictionary." Vol. 3. The Century Co., 1889. (Hydropical), p. 2939; " A New English Dictionary on Historical Principles." Vol. 5. The Clarendon Press, Oxford, 1901. (Hydropical), p. 490.

(16) URE, *loc. cit.*, p. 106.

have observed this fact and attributed to the " nitre of the Earth " the role of the acid. This is, of course, pure supposition and the use of the term " nitre " in an explanation of a reaction which takes place satisfactorily in the presence of nitric acid may simply be a coincidence.

Nevertheless, taking into account the loose phraseology and inaccurate and scattered data of the time, the description of adipocere in BROWNE's " Hydriotaphia " and the hypothesis of its formation are sufficiently close approximations to the truth to justify the occupation by Sir THOMAS BROWNE of the place accorded by URE to FOURCROY as " the scientific discoverer of this peculiar matter "—at least until some reference to a date previous to 1656 can be established.

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I am indebted to my sister, Miss ANNE BARNES, Honours Student in English at McGill University, for drawing my attention to " Hydriotaphia," and to Dr. W. W. FRANCIS, Librarian of the Osler Library, McGill University, for permission to examine the late Sir WILLIAM OSLER's copy of the first edition (1658) of " Hydriotaphia," which contains corrections in a hand believed to be that of Sir THOMAS BROWNE, and from which the excerpts given in this paper were transcribed.

McGill University
Montreal.

WILLIAM H. BARNES

Dr. Henry Power, disciple of Sir Thomas Browne [1]

I

In 1646, four years after the first edition of his *Religio Medici*, appeared the *Pseudodoxia Epidemica* (2) of Sir THOMAS BROWNE, which soon came to be known by the much handier title, " Vulgar Errors", a term frequently in use at the time for similar treatises. It is the most considerable of BROWNE's works, a miscellany of observations on all manner of subjects, divided into seven books treating respectively of general ideas, mineral and vegetable bodies, animals, man, pictures and customs, geographical and historical tenets, and Scriptural topics—an inexhaustible storehouse of entertainment that must have taken far more time to compose than the eleven years since the author had written the better known *Religio Medici*.

In the latter, the first published work of BROWNE, as readable for its mellow fluidity of thought as for its human, personal element of autobiography, never tiresomely profound nor becoming a parade of merely sonorous Latinity, BROWNE had commented on the multiplicity of books as follows :

Sect. XXIV.—I have heard some with deep sighs lament the lost lines of Cicero; others with as many groans deplore the combustion of the library at Alexandria :

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(1) Thanks are due to Prof. CHARLES SINGER, who first brought this topic to my attention; to Prof. HERBERT M. EVANS, for loan of a copy of POWER's book from his private collection at the University of California; and to Dean DOROTHY STIMSON, Goucher College, for notes on POWER's MS letters in the British Museum.

(2) The full title reads : *Pseudodoxia Epidemica : or, Enquiries into Very many received Tenents, And commonly presumed Truths. By Thomas Brovvne Dr. of Physick.* [quotation from JULIUS SCALIGER] *London, Printed by T. H. for Edward Dod, and are to be sold in Ivie Lane.* 1646. See also *Isis* XX, 337, 1934.

for my own part, I think there be too many in the world; and could with patience behold the urn and ashes of the Vatican, could I, with a few others, recover the perished leaves of Solomon. ... Some men have written more than others have spoken. PINEDA quotes more authors, in one work (3), than are necessary in a whole world. ... 'Tis not a melancholy *utinam* of my own, but the desires of better heads, that there were a general synod—not to unite the incompatible difference of religion, but,—for the benefit of learning, to reduce it, as it lay at first, in a few and solid authors; and to condemn to the fire those swarms and millions of rhapsodies, begotten only to distract and abuse the weaker judgments of scholars, and to maintain the trade and mystery of typographers. (4)

But in his " Vulgar Errors " BROWNE himself compounded a rhapsody of heavy learning, however much lightened from time to time by a ready wit and gracious periods, quoting so many writers of old and later ages that any patient pedant would surely have a lifetime of glorified research cut out for him to run down and verify all the citations.

At the time of publication of the " Vulgar Errors", HENRY POWER, the son of an old friend of BROWNE's (5), had been graduated two years from Christ's College, Cambridge, but was still at the University and was in correspondence with BROWNE, mayhap in connection with the new book (6) for, to a young man fond of all the curiosities of nature the work must have proved a capital delight (7). Its predecessor, the *Religio Medici*, which had

(3) BROWNE's note : " PINEDA, in his *Monarchia Ecclesiastica*, quotes one thousand and forty authors."

(4) Taken from WILKIN's ed. of the *Works;* 3 v., London, 1852; v. 2, p. 356-357.

(5) In a letter of 8 June 1659 BROWNE says to POWER : " ... the delight I have formerly had by many serious discourses with my old friend your good father, whose memorie is still fresh with mee and becomes more delightfull by this great enjoyment I have from his true and worthy sonne." (Sloane MS 3515, f. 60; given in WILKIN's ed. of the *Works*, *op. cit.*, v. 2, p. 519-521; reprinted in KEYNES's ed. of the *Works*) (6 v., London, 1928-1931) v. 6, p. 292-294, where the letter of POWER calling forth the comment is also given.)

(6) POWER (1623-1668) was BROWNE's earliest regular correspondent outside the latter's family (see the KEYNES ed. of the *Works*, *op. cit.*, p. [276]). The only letter of this year preserved (reprinted in KEYNES, p. 279-280) does not happen to mention the " Vulgar Errors "; it is apparently an acknowledgment of BROWNE's letter of advice on the study of medicine mentioned in note 10 : " ... I cannott but really thanke you for the Communication of your opinion; I shall trace your directions, by which meanes I question not but I shall attaine to the utmost of my desires."

(7) POWER's interest in natural history is evidenced by the letter mentioned in the preceding note : " ... I shall (submitting to your maturer judgment) review

reached five editions by 1645 (8), must likewise have furnished many hours of deep pleasure to him, for, as the author beautifully put it, " ... there are two books from whence I collect my divinity. Besides that written one of God, another of his servant, nature, that universal and publick manuscript, that lies expansed unto the eyes of all." (9)

Indeed, the *Religio Medici* may well have been the inspiration that led POWER to become a physician himself, for in the following year, 1646, he received from BROWNE a letter of advice concerning the study of medicine (10); and after POWER had received his M. A. in 1648 he sought to live near BROWNE in order to have the latter's personal guidance, telling him that at Cambridge there were " such few helpes " that he feared he would " make but a lingring progresse " in his plans for continued study. Whether or not POWER actually did go to live near BROWNE at Norwich (not far from Cambridge) is not known; but he did pursue his studies further, apparently making the best of what " helpes " he found at the University, and was created " doctor of physick " in 1655. For a few years he practised in Halifax, about 175 miles from London, and then moved to New Hall, not far away, where he remained the rest of his life (11).

II

In 1648, POWER's interest in natural history was still keen (12), and in 1653, two years before he received his doctor's degree,

the whole body of Philosophy, especially Naturall. The pleasantnesse of which science (had not your desires concurred) might have re-invited me to that study. "

(8) Two unauthorized eds. were issued in 1642, the first authorized ed. in 1643, and two eds. in 1645. (See GEOFFREY KEYNES : *A Bibliography of Sir Thomas Browne;* Cambridge Univ. Press, 1924.)

(9) *Religio Medici*, pt. 1, § xvi; WILKIN ed., *op. cit.*

(10) According to WILKIN (BROWNE : *Works, op. cit.;* v. 1, p. xlv) the letter pub. in *Biographia Britannica* (p. 633 of v. 2 of 2d ed. (5 v., London, 1778-1793) and reprinted in the KEYNES ed. of the *Works, op. cit.*, p. 277-278).

(11) Biographical data from *Dictionary of National Biography*, art. on BROWNE by A. H. BULLEN and on POWER by THOMPSON COOPER.

(12) Letters of POWER to BROWNE (10 Feb. and 15 Sept. 1648 and 28 Aug. 1649, given in KEYNES's ed. of BROWNE's *Works, op. cit.*, p. 280-288) regarding " the re-individualling of an incinerated plant", botanical collecting, anatomy, and physiology.

EXPERIMENTAL PHILOSOPHY,

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New Experiments { *Microſcopical,* *Mercurial,* *Magnetical.*

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By *HENRY POWER*, D. of Phyſick.

Perſpicillum (Microſcopicum *ſcilicet*) *ſi vidiſſet* Democritus, *exiluiſſet fortè; & modum videndi Atomum* (*quam ille invisibilem omninò affirmavit*) *inventum fuiſſe putâſſet.* Fr. Verulam. lib. 2. *Novi Organi*, ſect. 39.

Hinc igitur facillimè intelligere poſſumus, quam ſtultè, quam inaniter ſeſe venditat humana ſapientia, quóve ferantur noſtra Ingenia, niſi rectâ ratione, experientiâque (*ſcientiarum omnium magiſtra*) *nitantur & opinionis ſalebras accuratè vitent.* Muſſet. De Inſect. *cap.* 15. *pag.* 115.

LONDON,

Printed by *T. Roycroft*, for *John Martin*, and *James Alleſtry*, at the Bell in *S. Pauls* Church-yard. 1664.

we find him engaged in " mercuriall experiments", the results of which are recorded in the second part of his *Experimental Philosophy* and preserved among his papers (13). In 1656 he was in London, examining among other " rarityes " the sensitive and the humble plants (14). Two years later appeared the first edition of BROWNE's *Garden of Cyrus*, issued in the same cover following the *Hydriotaphia, Urne-Buriall*. The less fanciful portion of the former interested POWER enough to cause him to write BROWNE his reflections on some passages in it, including the sensitive and humble plants :

> ... In another paragraph you doe not only take notice but handsomely prove a continuall transpiration in plants like to that in animals; which continually renews their lopt-off flowers, and where it is large and excessive perchance doubles their flowers, now I am soe much your convert in this point, that I can easily stretch my beliefe a little farther, and that is to conceive that all plants may not only have a transpiration of particles but a sensation also like animals. This is eminently enough discoverable in those 2 exotic hearbs (the sensitive and humble plants) ...

Another passage in this letter :

> ... Thus certainly the smallest seeds are nothing but their own plants shrunk into an atome, which though invisible to us, are easyly discernable to nature, and to that piercing eie, that sees through all things. In vaine therefore may wee expect an ocular demonstration of these things, unles wee had such glasses (as some men rant of) whereby they could see the transpiration of plants and animals, yea the very magneticall *effluviums* of the loadstone. (15)

was apparently hitherto or afterward expanded into the " Magnetical Philosophy, 1659 " preserved among his MSS (16) and later treated more at length in the third part of the *Experimental Philosophy*.

POWER had heard of the recently formed Royal Society (17)

(13) Sloane MS 1380, art. 21; and possibly also MS 1380, art. 20, and MS 1333, art. 3. MSS cited here and below, exclusive of letters, are listed in *Dict. Nat. Biog.*

(14) Mentioned in a letter of 2 Aug. 1656 from Halifax to Doctor ROBINSON at Maldon (Sloane MS 1326, f. 13 r), possibly MATTHEW ROBINSON (1628-1694), fellow of Christ's Coll., Cambridge, in 1649, and correspondent of BROWNE (*Dict. Nat. Biog.*).

(15) WILKIN ed. of BROWNE, *op. cit.*, v. 2, p. 518-519; reprinted in KEYNES ed., *op. cit.*, p. 289-292.

(16) Sloane MS 1380, art. 18.

(17) The fruition of BACON's advocacy of the experimental method and a

in London, and in April 1661 he wrote to his friend, Doctor ROBINSON in Maldon (18), asking if he knew any member with whom he (POWER) might have correspondence (19). The contact was evidently made through JOHN TILLOTSON, who informed POWER (20) he had told the registrar of the Society about POWER's experiments and the members had entertained him as a candidate, on 8 May (21). The registrar thereupon wrote to him (22) requesting reports of experiments. POWER replied (23) by sending a " book on mercuriall experiments " (24), which was brought before the Society in October (25). These interested the " amateurs " so much that POWER was then requested to repeat them in part (26), and was elected a member on 26 February 1662 (27).

The bent of the Society at this time towards physical and astronomical problems is evident in succeeding correspondence. POWER is there requested to observe the weather at Halifax (28), for which a thermometer was sent to him (29); he reports on

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direct development from what ROBERT BOYLE called in 1647 " The *invisible* or (as they term themselves) the *philosophical college*", meeting at Gresham College in London; notably stimulated by the restoration of CHARLES II " in the wonderful pacifick year, 1660 " to become in November of that year an organized society of " amateurs " or " virtuosi", as they were variously called; known at the time frequently by POWER's expression, " the colledge for experimentall learning "; christened by JOHN EVELYN in 1661 the " Royal Society "; chartered by CHARLES II in 1662 under that name. (See *The Record of the Royal Society of London;* 3d ed., London, 1912; ch. I.).

(18) See note 14 above.

(19) Sloane MS 1326, f. 20 r.

(20) *Ibid.*, f. 27 v; TILLOTSON (1630-1694) became a member in 1671 and was later archbishop of Canterbury.

(21) THOMAS BIRCH : *The History of the Royal Society;* 4 v., London, 1756-1757; v. 1, p. 22.

(22) Sloane MS 1326, f. 26 v.

(23) *Ibid.*, f. 27 r.

(24) *Ibid.*, f. 25 r.

(25) BIRCH, *op. cit.*, p. 50.

(26) *Ibid.*, p. 53.

(27) *Ibid.*, p. 77; *Dict. Nat. Biog.* states that he and Sir JUSTINIAN ISHAM were the first elected fellows, on 1 July 1663. The confusion is due to the facts that a second royal charter was granted to the Society in April 1663 and, though in May it was decided that all who had hitherto sat as fellows were to be continued as such (BIRCH, *op. cit.*, p. 236), POWER was again proposed and on 1 July again elected, when he was formally admitted in person (*Ibid.*, p. 265, 268).

(28) *Ibid.*, p. 68.

(29) *Ibid.*, p. 320.

further " tampering with the load-stone " (30); experiments with gravity are recorded (31); he is asked to experiment on temperatures in caves (32), resulting in his "Subterraneous Experiments", Oct. 1662 (33), published in the *Experimental Philosophy* (34), and further experiments under ground (35), some of which the curator of the Society, ROBERT HOOKE, is requested to verify (36); he is asked to watch the lunar eclipse at Halifax in February 1663 (37); he designs an instrument for demonstrating the Copernican theory (38); he is requested to procure some astronomical writings of certain other " amateurs " in his neighborhood (39); further experiments in mines are desired and obtained (40); and observations on a comet are made (41).

But it is POWER's microscopical work that gives special luster to his name. In 1661 he had mentioned in correspondence with Doctor ROBINSON (42) that there were four microscopes in Halifax " as good as the world affordes ... and I have made a century of observations already". Some of these, as well as mercurial and magnetical experiments (43), were produced by him in person at a meeting of the Royal Society on 24 June 1663, when HOOKE among others was directed to make similar ones (44). HOOKE reported, in characteristic fashion, for he was an irascibly jealous worker, in a letter to BOYLE on 3 July :

> ... There is very little in Dr. *Power*'s microscopical observations but what you have since observed; only there is a pretty experiment he tried with the leeches in vinegar, that survived the freezing of the vinegar they lived in; and another pretty experiment he has in his philosophical reflections upon his obser-

(30) *Ibid.*, p. 81.
(31) ROBERT T. GUNTHER : *Early Science in Oxford;* v. 6, 1930, p. 89.
(32) BIRCH, *op. cit.*, p. 86; possibly " Experiments recommended to him by the Royal Society " (Sloane MS 1326, art. 10).
(33) Sloane MS 243, art. 56.
(34) P. [171]-181, and again in BIRCH, *op. cit.*, p. 133-136.
(35) BIRCH, *op. cit.*, p. 136-137, 144.
(36) *Ibid.*, p. 234.
(37) *Ibid.*, p. 193.
(38) *Ibid.*, p. 330.
(39) *Ibid.*, p. 395, 402.
(40) *Ibid.*, p. 430, 441; GUNTHER, *op. cit.*, p. 200.
(41) BIRCH, *op. cit.*, v. 2, p. 7.
(42) Sloane MS 1326, f. 20 v.
(43) BIRCH, *op. cit.*, v. 1, p. 271.
(44) *Ibid.*, p. 266.

vations, which is of making a certain kind of coals kindle into a fire and flame, by throwing water on them, when newly dug out of the mine. I am sorry to see, that he intends to publish several experiments about colours, which I am confident might be originally yours. He will likewise publish the experiment of freezing an eye, to find the shape of it, whose invention he ascribes to another. There is not much more besides, that is very considerable in it, and therefore I shall refer the further account of it till your return, till when I shall keep the book by me. (45)

At any rate, POWER's observations were ready for publication in 1661, since the "Preface to the Ingenious Reader" is dated 1 August of that year. It was, perhaps, his visit to the Royal Society in 1663 that led directly to the publication of his book, *Experimental Philosophy*, for the titles to the second and third parts are both dated 1663 and the imprimatur facing the first title-page is dated "Aug. 5. 1663." This book was not issued, apparently, until 1664, the date on the first title-page. It is a rather scarce work today (46), only six copies being listed in forty years of auction records, so its oversight by historians of literature is hardly unexpected.

(45) Hon. ROBERT BOYLE: *Works;* 6 v., London, 1772; v. 6, p. 487. This may have been the stimulus for the eventual publication of HOOKE's microscopical observations, under way since before POWER's visit, which were printed in the fall of 1664 but not published till April 1665, under the title: *Micrographia: or, Some Physiological Descriptions of Minute Bodies made by Magnifying Glasses* (GUNTHER, *op. cit.*, p. 125, 126, 127, 141, 172, 182, 219, 241).

(46) The *Experimental Philosophy* is the first work on microscopy pub. in England, antedating by less than a year, however, HOOKE's more famous work, mentioned in the preceding note. Bibliographical description of the Evans copy: *Experimental Philosophy, In Three Books: Containing New Experiments} {Microscopical, Mercurial, Magnetical. With some Deductions, and Probable Hypotheses, raised from them, in Avouchment and Illustration of the now famous Atomical Hypothesis. By Henry Power, Dr. of Physick.* [two quotations, from BACON and MUFFET] *London, Printed by T. Roycroft, for John Martin, and James Allestry, at the Bell in S. Pauls Church-yard.* 1664. Small 4to. *a-c*, B-Bb in fours, 1 leaf; 12 leaves, 193 p. (really 191 p., p. 185-186 being omitted in numbering but not in signature), leaf of errata; separate titles for books two and three included in pagination; 1 fold. plate of engr. illus. (for book two) precedes p. 1; 5 woodcut initials and 5 woodcut illus. of undistinguished workmanship; marginal notes. The head-pieces before the preface, the text of each part, and the conclusion are interesting for containing five lines of type-ornaments each (except the one preceding the half-title of the second book, which contains only the three middle lines). The facts that in each appearance one of the ornaments in the middle row is inverted and that the lines are broken by various punctuation points in the same positions in the lines, even though one head-piece is reversed on the page, indicate that all the book was probably printed at approximately the same time. The printers were the official printers to the Royal Society.

III

" The Preface to the Ingenious Reader", evidently written only for the first book, is too long to quote entirely, but a few excerpts must be given to show the engaging quality of the man (47) :

Dioptrical glasses (which are now wrought up to that height and curiosity we see) are but a modern invention : antiquity gives us not the least hint thereof, neither do their records furnish us with any thing that does antedate our late discoveries of the telescope, or microscope. The want of which incomparable artifice made them not onely erre in their fond coelestial hypothesis, and crystalline wheel-work of the heavens above us, but also in their nearer observations of the minute bodies and smallest sort of creatures about us, which have been by them but sleightly and perfunctorily described, as being the disregarded pieces and huslement of the creation; when (alas !) those sons of sense were not able to see how curiously the minutest things of the world are wrought, and with what eminent signatures of Divine Providence they were inrich'd and embellish'd, without our dioptrical assistance. Neither do I think that the aged world stands now in need of spectacles, more than it did in its primitive strength and lustre : for howsoever though the faculties of the soul of our primitive father Adam might be more quick & perspicacious in apprehension, than those of our lapsed selves; yet certainly the constitution of Adam's organs was not divers from ours, nor different from those of his fallen self, so that he could never discern those distant, or minute objects by natural vision, as we do by the artificial advantages of the telescope and microscope. So that certainly the secondary planets of Saturn and Jupiter and his ansulary appearances, the *maculae solis*, and lunations of the inferiour planets, were as obscure to him as unknown to his posterity; onely what he might ingeniously ghess at by the analogie of things in nature, and some other advantageous circumstances.

... [By " our modern engine (the microscope)"] you may see what a subtil divider of matter Nature is; herein we can see what the illustrious wits of the atomical and corpuscularian philosophers durst but imagine, even the very atoms and their reputed indivisibles and least realities of matter, nay the curious mechanism and organical contrivance of those minute animals, with their distinct parts, colour, figure and motion, whose whole bulk were to them almost invisible : so that were ARISTOTLE now alive, he might write a new history of animals; for the first tome of zoography is still wanting, the naturalists hitherto having onely described unto us the larger and more voluminous sort of animals, as bulls, bears, tygers, &c. whilst they have regardlessly pass'd by the insectile *automata*, (those living-exiguities) with only a bare mention of their names, whereas in these prety engines (by an incomparable stenography of Providence) are lodged all the perfections of the largest animals; they have the same organs of body, multiplicity of parts, variety of motions, diversity of figures, severality of functions with those of the largest size : and that which augments the miracle, is, that all these

(47) For ease in reading, the long " s", capitals, and italics are modernized, and the occasional errata corrected, in the quotations.

in so narrow a room neither interfere nor impede one another in their operations. Who therefore with the learned* [Dr. BROWN, *Relig. Med.*] Doctor, admires not REGIOMONTANUS his fly beyond his eagle, and wonders not more at the operation of two souls in those minute bodies, than but one in the trunk of a cedar? Ruder heads stand amazed at those prodigious and colossean pieces of Nature, as whales, elephants, and dromedaries; but in these narrow engines there is more curious mathematicks, and the architecture of these little fabricks more neatly set forth the wisdom of their Maker.

... therfore at present we shal keep within the compass of the microscope, and look at nothing further than what we can discover therein: The knowledge of man (saith the learn'd VERULAM) hath hitherto been determin'd by the view or sight, so that whatsoever is invisible, either in respect of the fineness of the body it self, or the smalness of the parts, or of the subtilty of its motion, is little enquired; and yet these be the things that govern Nature principally: how much therefore are we oblig'd to modern industry, that of late hath discover'd this advantageous artifice of glasses, and furnish'd our necessities with such artificial eys, that now neither the fineness of the body, nor the smalness of the parts, nor the subtilty of its motion, can secure them from our discovery? And indeed, if the dioptricks further prevail, and that daring art could but perform what the theorists in conical sections demonstrate, we might hope, ere long, to see the magnetical effluviums of the loadstone, the solary atoms of light (or *globuli aetherei* of the renowned DES-CARTES) the springy particles of air, the constant and tumultuary motion of the atoms of all fluid bodies, and those infinite, insensible corpuscles (which daily produce those prodigious (though common) effects amongst us:) and though these hopes be vastly hyperbolical, yet who can tel how far mechanical industry may prevail; for the process of art is indefinite, and who can set a *non-ultra* to her endevours? I am sure, if we look backwards at what the dioptriks hath already perform'd, we cannot but conclude such prognosticks to be within the circle of possibilities, and perhaps not out of the reach of futurity to exhibit: however this I am sure of, that without some such mechanical assistance, our best philosophers will but prove empty conjecturalists, and their profoundest speculations herein, but gloss'd outside fallacies; like our stage-scenes, or perspectives, that shew things inwards, when they are but superficial paintings.

For, to conclude with that doubly Honourable (both for his parts and parentage) Mr. BOYLE, When a writer, saith he, acquaints me onely with his own thoughts or conjectures, without inriching his discourse with any real experiment or observation, if he be mistaken in his ratiotination, I am in some danger of erring with him, and at least am like to lose my time, without receiving any valuable compensation for so great a loss: but if a writer endevours, by delivering new and real observations or experiments, to credit his opinions, the case is much otherwayes; for, let his opinions be never so false (his experiments being true) I am not oblig'd to believe the former, and am left at my liberty to benefit my self by the latter: and though he have erroneously superstructed upon his experiments, yet the foundation being solid, a more wary builder may be very much further'd, by it, in the erection of a more judicious and consistent fabrick.

Surely we have here in abundant beauty the *religio medici* combined, even if but unconsciously, with the *religio grammatici*. The Cartesian philosophy seems to be the springboard for POWER's

speculations, the work of BOYLE the incitus (48) for his faithful adherence to the experimental method, and the rich language of his friend and mentor, BROWNE, the pattern for his rhetoric. A few of the fifty-one Observations are here excerpted.

Observat. I.
Of the Flea.

It seems as big as a little prawn or shrimp, with a small head, but in it two fair eyes globular and prominent of the circumference of a spangle; in the midst of which you might (through the diaphanous cornea) see a round blackish spot, which is the pupil or apple of the eye, beset round with a greenish glistering circle, which is the iris, (as vibrissant and glorious as a cats eye) most admirable to behold.

How critical is Nature in all her works! that to so small and contemptible an animal hath given such an exquisite fabrick of the eye, even to the distinction of parts.

... He has also a very long neck, jemmar'd like the tail of a lobstar, which he could nimbly move any way; his head, body, and limbs also, be all of blackish armour-work, shining and polished with jemmar's, most excellently contrived for the nimble motion of all the parts: Nature having armed him thus *cap-a-pe* like a curiazier in warr, that he might not be hurt by the great leaps he takes; to which purpose also he hath so excellent an eye, the better to look before he leap: to which add this advantageous contrivance of the joynts of his hinder legs which bend backwards towards his belly, and the knees or flexure of his fore-legs forwards (as in most quadrupeds) that he might thereby take a better rise when he leaps. His feet are slit into claws or talons, that he might the better stick to what he lights upon: he hath also two pointers before which grow out of the forehead, by which he tryes and feels all objects, whether they be edible or no. His neck, body, and limbs are also all beset with hairs and bristles, like so many turnpikes, as if his armour was palysado'd about by them. At his snout is fixed a proboscis, or hollow trunk or probe, by which he both punches the skin, and sucks the blood through it, leaving that central spot in the middle of the flea-biting, where the probe entred.

One would wonder at the great strength lodged in so small a receptacle, and that he is not able onely to carry his whole armour about him, but will frisk and curvet so nimbly with it: stick a large brass pin through his tayl and he will readily drag it away. I have seen a chain of gold ... of three hundred links, though not above an inch long, both fastned to, and drawn away by a flea. Such a like one it seems as our MUFFET (49) tells that one MARCUS an English-man made.

(48) In a letter of 25 Sept. 1661 (Sloane MS 1326, f. 20 v) to ROBINSON, POWER says: "... I should be much honoured though, if you could promote my acquaintance so high as to reach Mr. BOILE, whose mechanicall witt and ingenious Industry all the world does admire ..."

(49) MUFFET (THOMAS MOFFETT, 1553-1604) proves to be a frequent source of reference by POWER. Since he quotes in Latin he probably knew the first, but posthumous, ed. of 1634 entitled *Insectorum sive Minimorum Animalium Theatrum*. Perhaps he had not seen the English translation, *The Theater of Insects*, issued as an appendix to the 2d ed. of EDWARD TOPSELL's *History of Four-Footed Beasts and Serpents*, 1658.

... Yea, we have heard it credibly reported, saith he, that a flea hath not onely drawn a gold chain, but a golden charriot also with all its harness and accoutrements fixed to it, which did excellently set forth the artifice of the maker, and strength of the drawer; so great is the mechanick power which Providence has immur'd within these living walls of jet. (50)

BROWNE's quotation from SCALIGER on the title of the " Vulgar Errors " (To collect [knowledge] out of books which authors produced long since is very dangerous; true knowledge of things is to be gained from the things themselves.) is less heeded than referred to in that work, which consists in so large degree of compilation from ARISTOTLE, PLINY, and later naturalists rather than of exact observation alone. This is not at all the practice of POWER, who in Observation II and Observation XXXI scores the theoretical writers :

Observat. II.
The Bee.

The eye of a bee is of a protuberant oval figure, black and all foraminulous, drill'd full of innumerable holes like a grater or thimble; and, which is more wonderful, we could plainly see, that the holes were all of a square figure like an honey-comb, and stuck full of small hairs (like the pores in our skin) and which (by blowing upon) you might see waft to and fro; all which neat particularities were more palpably discovered in the eye of a great humble-bee. Now these holes were not absolute perforations, but onely dimples in their crustaceous *tunica cornea;* which it seems is full of little pit-holes, like the cap of a thimble : for we cutt out the eye in a large humble-bee and crecket, and bared the shell or horney coat of the eye; and laying either the convex or concave side upwards (upon the object plate) I could easily perceive the little holes or dimples formerly mentioned. So that, by the favour of our microscope, I have seen more in one hour then that famous bee-master ARISTOMACHUS (51) did in his fifty years contemplation of those laborious insects.

If you divide the bee (or humble-bee especially) near the neck, you shall, without help of the glasse, see the heart beat most lively, which is a white pulsing vesicle.

(50) This observation on the flea is used by JOSEPH GLANVILL in his *Plus Ultra : or, The Progress and Advancement of Knowledge Since the Days of Aristotle ;* London, 1668 (a defence of the Royal Society in its early days), as an argument for the use of the microscope in helping the unaided senses to extend the bounds of knowledge : " ... [the microscope] represents that little creature as bristled and jamar'd ..." (p. 66); " This instrument hath been exceedingly improved of late, even to the magnifying of objects a thousand times, and many useful theories have been found and explicated by the notices it hath afforded; as appears by the microscopical writings of those ingenious mechanicks, members of the Royal Society, Dr. POWER and Mr. HOOKE." (p. 57).

(51) A Peripatetic philosopher of the 3d cent. B.C., who wrote on natural history and agriculture, studying bees for 60 years; frequently cited by PLINY. *(Larousse).*

The stings in all bees are hollow and tubulous (like a shoomaker's-punch) so that when they prick the flesh, they do also, through that channel, transfuse the poyson into it : for if you take a bee, wasp, or humble-bee especially, and gently squeeze her tayl, so that you may see the sting, you shall perceive a drop of diaphanous liquor at the very end of it, which if you wipe off, you shall distinctly see it renewed again, that humour passing down the cavity into the end thereof. But if you would see their common-wealth, laws, customs, military discipline, and their skill in tacticks and architecture, then read our English Butler (52), an experimental and not theoretical writer on that subject.

Observ. XXXI.
Of the great Black Snail.

In this slimy animal (the slow-paced engine of Nature) are very many rare and excellent observables. The first is his eyes, which are four in number, (like black atramentous spots) fixed to the end of their horns ... And therefore however, though the learned Doctor BROWN (my ever honoured friend) hath ranked this conceit of the eyes of a snail (and especially their quadruplicity) amongst the vulgar errours of the multitude; yet through a good microscope, he may easily see his own errour, and Nature's most admirable variety in the plurality, paucity, and anomalous situation of eyes, and the various fabrick and motion of that excellent organ; as our observations will more particularly inform him. ...

Another correction to BROWNE is in :

Observat. V.
The Butter-Fly.

This animal might well deserve our observation without the assistance of a microscope; for who does not admire the variegated diversity of colours in her expansed wings? which do not onely out-vye the peacock in all his pride, but does as far out-go the strip'd bravery of the tulip, as that did SOLOMON in all his glory : but view them in the microscope, and you may see the very streaks of the Coelestial pencil that drew them. For the wings of the butterfly seem like a great plume of feathers, with a glystering splendour exceeding pleasant to behold, especially if the wings be strip'd with several colours : yea that small meal and dust of their wings (which sticks to your fingers when you catch them) is all small little feathers, which grow out of their wings; and you may plainly see the twills by which they stick to the wings, and the holes in the wings, out of which they were pluck'd. Nature having imp'd her wings (for her better flight) with those plumeous excrescences; which shews how vastly* [*Dr. BROWN in his *Vulgar Errors*.] they were mistaken, that held this mealy dust to be an exudation of atoms out of their wings.

Her eye is large and globular (but somewhat flattish) white like alablaster, diced or bespeck'd here and there with black spots (like checker'd marble) all foraminous, both the white and black parts of it. ...

The observation on the house-spider is classical in its charm :

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(52) Probably CHARLES BUTLER (d. 1647), who wrote *The Feminine Monarchie; or, A Treatise concerning Bees;* 1609; 2d ed., 1623; 3d ed., 1634. *(Dict. Nat. Biog.)*

Observat. VIII.

The House-Spider.

Now let us see what we can discover in OVID's Lydian-spinstresse, that proud madam which PALLAS, for her rivalship,transform'd into the spider; which hath not onely the character of ARISTOTLE, but of SOLOMON himself, for a wise and prudent animal, and therefore a fit residentiary in the court of kings.

Of domestick spiders there are two sorts; one with longer legs and a little body, and the other contrariwise.

The first eminent thing we found in these house-spiders, were their eyes, which in some were four, in some six, and in some eight, according to the proportion of their bulk, and longity of their legs. These eyes are placed all in the forefront of their head (which is round, and without any neck) all diaphanous and transparent, like a locket of diamonds, or a sett of round crystal-beads .,.

Neither wonder, why Providence should be so anomalous in this animal more then in any other we know of (Argus his head being fix'd to Arachne's shoulders.) For, first : since they wanting a neck cannot move their head, it is requisite that defect should be supplyed by the multiplicity of eyes. Secondly : since they were to live by catching so nimble a prey as a fly is, they ought to see her every way, and to take her *per saltum* (as they do) without any motion of their head to discover her; which motion would have scar'd away so timorous an insect.

They have a very puffy light body of an oval figure, covered with a sleek thin skin : which they change once a moneth, sayes Muffet; though I hardly believe they cast their spoils so often.

Their skin is not pellucid, for I could never discover any pulsing particle within them: she hath eight legs, four on each side, split into small oblong fingers at the ends, by which she makes her curious web-work. Both body and limbs is all stuck over with small silver hairs, which the very ayr will waft to and fro, as you may see in the microscope.

The wonders seen through his glasses easily led POWER to speculate, as in

Observat. XII.

Mites in Cheese.

... the legs were just like to those in a louse, jemmar'd and transparent : she has two little pointers at the snout; nay, you may see them sometimes, if you happily take the advantage, like so many ginny-pigs, munching and chewing the cud : about the head and tail are stuck long hairs or bristles : some we could see (as little, even in the glass, as a mustard-seed) yet perfectly shap'd and organiz'd : we also saw divers atoms somewhat transparent like eggs, both in form and figure. Nay, in these moving atoms, I could not onely see the long bristles formerly specified, but also the very hairs which grew out of their leggs, which leggs themselves are smaller than the smallest hair our naked eyes can discover. What rare considerations might an ingenious speculator take up here, even from this singular experiment? of the strange and most prodigious skilfulness of Nature in the fabrick of so minute an animal (a thousand whereof do not weigh one single grain, (for one seed of tobacco is bigger than any of them) and yet how many thousand parts of matter must go to make up this heterogeneous contexture? For, besides the parts inservient to nutrition, sensation, and motion, how small and thin must the liquours be that circulate through the pipes and vessels dissem-

inated through those parts? nay, how incomprehensibly subtil must the animal-spirits be,that run to and fro in nerves included in such prodigiously little spindle-shank'd leggs?

That POWER had other publications in mind is apparent from remarks in Observation XVIII about telescopical observations to be later discoursed of. An incidental reference to exact measurement is found in

Observat. XXV.

For that all vegetables have a constant perspiration, the continual dispersion of their odour makes out; besides an experimental eviction I shall give you by this singular experiment: 23. of Feb. (—61.) we weighed an onyon exactly to two ounces, two scruples and a half, and hanging it up till the 6. of May next following (at which time it had sprouted out a long shoot) we then, upon a re-ponderation of it, found it had lost near two drams of its former weight, which was exhaled by insensible transpiration.

Experimentation in addition to observation is well illustrated by

Observat. XXX.

Of the little white Eels or Snigs, in Vineger or Aleger.

They appear like small silver-eels, or little snigs, and some of them as long as my little finger, constantly wrigling and swimming to and fro with a quick, smart, and restless motion. In which smallest of animals these things are most remarkable:

First, they are not to be found in all sorts of vineger nor aleger, but onely in such, probably, as has arrived to some peculiar temper or putrefaction ... for, I have found them in all sorts of vineger, both in the keenest and smartest, as well as in the weakest and most watrish vineger; and in all these sorts, you shall sometimes find none at all; and I have both found them, and also vainly sought them, in the former liquors, at al seasons and times of the year also.

Secondly, the manner and best way of observing them is, upon a plain piece of white glass, whereon two or three drops of the said liquors are laid ...

Thirdly, nay you may see them (especially in old aleger) with the bare eye, if you put a little of it into a clear Venice-glass, especially into those pure thin white bubbles, which they call essence-glasses ...

Fourthly, that as the liquor (dropt upon your object-plate) spends and dries up, so you shall see those little quicks to draw nearer and nearer together, and grow feebler in their motion; and when all the vineger or aleger is dried away, then they lie all dead, twisted and complicated all together, like a knot of eels, and after a little time dry quite away to nothing.

Fifthly, their heads and tails are smaller then the rest of their bodies; which is best observed by the microscope, when the liquor wherein they swim is almost spent and dried up, so that their motion thereby is rendred more feeble and weak, or when they lie absolutely dead.

Sixthly, another remarkable thing, is, their exceeding exiguity; for certainly

of all animals they are the least that can be seen by the bare eye, which is helped and advantaged also by the refraction of the water wherein they swim.

Seventhly, if you take a spoonful of the foresaid vineger and heat it over a few coals, it presently destroys all the quick's in it, so that you may see them all stretched out at their full length, like a pencil chopt small, or little bits of hairs swimming up and down the liquor ...

Nay these poor vermin are not onely slain by actual heat, but by a potential one also : for, putting but a few drops of the oyle of vitriol into an essence-glass full of that vineger, it also shortly destroyed them in the same manner as the fire had done before.

Eighthly, now though heat hath that killing property, yet it seems that cold hath not : for I have taken a jar-glass full of the said vineger, and by applying snow and salt to it, I have artificially frozen all the said liquor into a mass of ice, (wherein all these animals it seemed lay incrystalled) though I could discover none of them in it (though I have taken the icy-mass out on purpose to look at it) so that now I gave them for gone for ever : yet when I came again (about two or three hours after) to uncongeal the liquor, by keeping the glass in my warm hand, when the vineger was again returned to its former liquidity, all my little animals made their re-appearance, and danced and frisked about as lively as ever. Nay I have exposed a jar-glass full of this vineger all night to a keen frost, and in the morning have thaw'd the ice again, and these little vermin have appeared again and endured again that strong and long conglaciation without any manifest injury done to them; which is both a pretty and a strange experiment.

Ninthly, I have filled an essence-glass half with the said vineger, and half with oyle (which floated on the vineger) in a distinct region by it self,and I have observed that in frosty weather when the vineger has been congealed, that all the little eels have run up into the super-incumbent oyle to preserve themselves there, and would not return till some warmth was applyed to the vineger again, and then they would always presently return down into their native liquor again.

Tenthly, their motion is very remarkable, which is restless and constant, with perpetual undulations and wavings, like eels or snakes; so that it seems, that animals that come nearest the classis of plants, have the most restless motions.

Eleventhly, the innumerable number and complicated motion of these minute animals in vineger, may very neatly illustrate the doctrine of the incomparable DES-CARTES, touching fluidity : *(viz.)* that the particles of all fluid bodies are in a continual and restless motion ... notwithstanding that the unassisted eye can discover no such matter ...

WILLIAM HARVEY's experiments on the circulation of the blood were of course known to POWER, and he quotes HARVEY from time to time. On his own account, too, he proves the circulation of blood in the lamprey (Observation XXXII) : " So that in this animal, and snakes also, you may distinctly see the bloud's circulation." Besides animals, POWER used his microscope on seeds, pollen, metal powders, the weave of cloth, leaves, pencil lines, and the mark of steel sparks from flint. On artificial productions he animadverts quaintly in

Observat. XLVIII.

A line drawn upon paper.

As these dioptrical glasses, do heighten and illustrate the works of Nature, so do they on the other side, disparage and depretiate those of art : for as they shew the incomparable exactness of the former, so do they discover the flaws and deficiencies of the latter; for a right line either printed or drawn never so neatly upon paper appears all ragged, indented, and discontinued by the rugosities and seeming protuberances of the paper, in which likewise you may see whole clouds, as it were, of raggs, the primitive materials thereof.

I had a rarity bestowed on me by Master TAYLOR (once a famous scrivener in these parts) which is, the Lords Prayer and Creed writ in words at length, and a breviate also of the Ten Commandments, and all couched (but distinctly writ) in the compass of a single penny. In the microscope you might read it all, as if it were writ in text hand, but all the letters appeared (as we have observed of the line) crooked and unhandsome; so inartificial is art when she is pinched and streitned in her workmanship.

The first fifty-six pages of the book are concerned with definite observations. Beginning with Observation LI, POWER presents in a not uninteresting manner his views as to the meanings behind the discoveries he has revealed, and he ventures an unwitting prophecy of the cosmological speculations of EDDINGTON and JEANS :

Indeed if our dio[p]tricks could attain to that curiosity as to grind us such glasses, as would present the effluvium of the magnet, we might hazard at last the discovery of spiritualities themselves : however it would be of incomparable use to our modern corpuscularian philosophers, who have banished qualities out of the list of the predicaments. And truly, as the learned Doctor BROWN hath it; The doctrine of effluxions, their penetrating natures, their invisible paths, and unsuspected effects, are very considerable : for (besides the magnetical one of the earth) several effusions there may be from divers other bodies, which invisibly act their parts at any time, and perhaps through any medium : a part of philosophy but yet in discovery; and will, I fear, prove the last leaf to be turned over in the book of Nature.

In the first part of this speculative section occurs a lengthy and involved " Digression of the Animal Spirits", the conclusion of which is amusing :

Lastly, I have but one paradoxical and extravagant *quaere* to make, and that is this; that since we have proved these animal spirits to be the ultimate result of all the concoctions of the body, the very top and perfection of all Nature's operations, the purest and most aetherial particles of all bodies in the world whatsoever, (and so consequently of nearest alliance to spiritualities) and the sole and immediate instrument of all the soul's operations here ... (the body and the organs thereof, being but secondary and subservient instruments to the spirits :) these

things being thus premised, may it not be probable enough that these spirits in the other world, shall onely be the soul's vehicle and habit ... by a vital re-union with which, it may supereminently out-act all that ever she was able to do in this earthly prison and heavy cottage of the body; since also (which I may super-adde) those volatile spirits (being freed by a constant and perpetual dissipation from the body) are diffused through this great aetherial ocean, as into their proper element, ready to be united to the soul at the instant of her separation.

There follows a " Fourth Deduction", treating of the Cartesian theory of colors, supported by a number of simple chemical experiments. The " Fifth Corollary " is on anatomical considerations about the eye, and POWER's microscope has been used to good effect in observing its structure. His introduction to this section is interesting :

Our next reflections shall be made upon the eye, to admire as well as contemplate Nature's variety in the constructure and conformation of so excellent an organ : the two luminaries of our microcosm, which see all other things, cannot see themselves, nor discover the excellencies of their own fabrick : Nature, that excellent mistress of the opticks, seems to have run through all the conick sections, in shaping and figuring its parts; and dioptrical artists have almost ground both their brain and tools in pieces, to find out the arches and convexities of its prime parts, and are yet at a loss, to find their true figurations, whereby to advance the fabrick of their telescopes and microscopes : which practical part of opticks is but yet in the rise; but if it run on as successfully as it has begun, our posterity may come by glasses to out-see the sun, and discover bodies in the remote universe, that lie in vortexes, beyond the reach of that great luminary. At present let us be content with what our microscope demonstrates; and the former observations, I am sure, will give all ingenious persons great occasion, both to admire Nature's anomaly in the fabrick, as well as in the number of eyes, which she has given to several animals ...

The conclusion of this section closes also the microscopical portion of the work, and is a fitting expression of POWER's stirring faith in the " experimental philosophy " :

... and if we can, by any artificial helps, get but a glimpse of the smallest truth, it is not to tell what a fabrick of philosophy may be raised from it; (for to conclude with that patriark of experimental philosophy, the learned Lord BACON,) The eye of the understanding, saith he, is like the eye of the sense; for as you may see great objects through small cranies or levels; so you may see great axioms of Nature, through small and contemptible instances and experiments.

These are the few experiments that my time and glass hath as yet afforded me an opportunity to make, which I hasten out into the world to stay the longing thereof; but you may expect shortly from Doctor WREN, and Master HOOKE, two ingenious members of the Royal Society at Gresham, the cuts and pictures drawn at large, and to the very life of these and other microscopical representations.

A great pity that these promised illustrations have not come to light; but we may console ourselves with the inimitable word-pictures POWER has so charmingly presented to the inner eye.

IV

The second and third books are of little interest from the standpoint of this paper, for their subject-matter, being more quantitative than qualitative, lends itself to less expansiveness of the imagination than the dioptrical observations. The second book contains " physico-mechanical experiments ... of four sorts, hydrargyral, hydraulical, pneumatical, and mixt." These were begun in 1653, as mentioned above, and deal chiefly with mercury and water-tubes; chapter VIII of this section continues :

> Additional Experiments made at Townley-Hall, in the years 1660. and 1661. by the advice and assistance of that Heroick and Worthy Gentleman, RICHARD TOWNLEY, Esqr. and those Ingenious Gentlemen Mr. JOHN, and Mr. CHARLES TOWNLEY, and Mr. GEORGE KEMP.
>
> The last year, 1660. came out that excellent tractate of experiments of Esqr. BOYLE's (53), with his pneumatical engin, or ayr-pump, invented, and published by him; wherein he has, by virtue of that rare contrivance, outdone all that ever possibly could be performed by our late mercurial and experimental philosophers: and, indeed, to give a true and deserved character of that worthy production of his, I must needs say, I never read any tractate in all my life, wherein all things are so curiously and critically handled, the experiments so judiciously and accurately tried, and so candidly and intelligibly delivered. I no sooner read it, but it rubbed up all my old dormant notions, and gave me a fresh view of all my former, and almost-forgotten, mercurial experiments. Nay, it had not that effect onely on me, but likewise it excited and stirr'd up the noble soul of my ever honoured friend, Mr. TOWNLEY, together with me, to attempt these following experiments.

Twelve experiments are then given, occupying the rest of the chapter and all of the next. Chapter X is concerned with an explanation of the observed phenomena, dismissing in short order the views of various previous writers : " Now to salve all these mercurial phaenomena, as also those mixed experiments of quick-silver and water, quicksilver and ayr, ayr and water, in single and

(53) *New Experiments Physico-Mechanicall, Touching The Spring of the Air, and its Effects, (Made, for the most part, in a New Pneumatical Engine)* ; Oxford, 1660.

double tubes and syphons of all bores, divers learned and ingenious heads have excogitated several neat, though different, hypotheses ..." But he confutes at greater length the observations of a certain LINUS, *alias* HALL (54), whom he treats as follows :

> Now for the positive arguments to avouch his principles by, he has none at all; onely what he fetches *à posteriori*,from his commodious solution of difficulties, and salving the phaenomena better then others have done. For read him through, and you shall see he hangs so like a tumbler by this rope, that swing him which way you will, you cannot get him off; though, I doubt not, but we shall prove his cord to be a mere rope of sand, and of his own twisting; and reason will, Sampson-like, break it easily in pieces.

Chapter XI is a detailed " Confutation of this Funicular Hypothesis of LINUS". The next chapter consists of five experiments with capillary tubes and siphons, as a result of which " My worthy and ever honoured friend, Mr. CHARLES TOWNLEY, upon confidence of these experiments, thought he had discovered that great, and long sought-for rarity amongst the mechanicks *(viz.)* a perpetual motion ..." " Now however this same problem ... might seem probable in the theory, yet it will prove more than most difficult (if not impossible) in the practice." And it did turn out so. Nothing daunted, however, POWER expects the Royal Society to achieve it one day : " But these, and a hundred more experiments of this nature are every day excogitated and tried by our noble Society of Gresham-Colledge, which in a little time will be improved into far nobler consequences and theories, than can possibly be done by the single endevours of any person whatsoever." This is the conclusion of the second book.

The third book is concerned with magnetical experiments and

(54) FRANCIS LINE, *alias* HALL (1595-1675) published in 1661 his *Tractatus de Corporum Inseparabilitate; in quo Experimenta de Vacuo, tam Torricelliana, quàm Magdeburgica, & Boyliana, examinantur.* BOYLE also replied to LINUS in his 2d ed. of the *New Experiments*, 1662, which included a tract entitled *A Defence Of the Doctrine touching the Spring and Weight Of the Air ... Against the Objections of Franciscus Linus. Wherewith the Objector's Funicular Hypothesis is also examin'd.* The 2d ed. of BOYLE is notable for containing the first statement of " BOYLE's Law". LINUS had another confuter in the person of GILBERT CLERKE, who also in 1662 wrote a *Tractatus de Restitutione Corporum, in quo Experimenta Torricelliania et Boyliana explicantur ... per modum Responsionis Epistolicae ad... F. Linum de Inseparabilitate Corporum.* (See J. F. FULTON: *A Bibliography of The Honourable Robert Boyle.* In *Oxford Bibliographical Society : Proceedings and Papers*, v. 3, pt. 1, 1931.)

speculations on the nature of magnetical emanations, in the form of a confutation of Grand Amicus (55). The second chapter is almost a repetition of the beginning of the speculative section in the first book :

> Of the Corporeal Effluviums of the Loadstone.
>
> Doctor HIGHMORE (56) tells us, that the magnetical expirations of the loadstone may be discovered by the help of glasses, and be seen in the form of a mist, to flow from the loadstone : this, indeed, would be an incomparable eviction of the corporeity of magneticall effluviums, and sensibly decide the controversie under consideration. But I am sure he had either better eyes, or else better glasses than ever I saw (though I have look'd through as good as England affords) and the best of them all was as far from presenting these subtil emanations, that they would never exhibit to me those grosser, and far more material, effluviums, from electrical and aromatical bodies : nay, not the evaporations of camphire, which spends it self by continually effluviating its own component particles : nay, I could never see the grosser steams, that continually transpire out of our own bodies, and are the fuliginous eructations of that internal fire which constantly burns within us. Indeed, if our dioptricks could attain to that curiosity, as to grind us such glasses as would present the effluviums of the magnet; we might hope to discover all EPICURUS his atoms, DES-CARTES his *globuli aetherii*, and all those insensible corpuscles which daily produce such considerable effects in the generation and corruption of bodies about us : nay, might not such microscopes hazard the discovery of the aerial *genii*, and present even spiritualities themselves to our view? But though both our natural and artificial eyes fail in this performance, yet have we another more intrinsick eye, that will yet discover their materiality, and that is the piercing eye of reason.

Following the magnetical experiments are the " Subterraneous Experiments; or, Observations about Cole-Mines " which, as we have seen, were requested of him by the Royal Society; the language of the report is wholly prosaic, so we may judge the performance to have been a quite uninspiring one to the doer.

The conclusion to the whole volume is addressed " To the generous Virtuosi, and Lovers of Experimental Philosophy." In deploring the unreasonableness of the multitude, POWER expresses also a thorough disesteem of the traditional professors nourished on scholastic philosophy, whose security in the cloisters of the

(55) JACQUES GRANDAMI (1588-1672), Jesuit physicist and astronomer, wrote a *Nova Demonstratio Immobilitatis Terrae Petita ex Virtvte Magnetica;* La Flèche, 1644. *(Larousse)*

(56) NATHANIEL HIGHMORE (1613-1685), physician, published his thesis, *Corporis Hvmani Disqvisitio Anatomica*, and *The History of Generation* in 1651, and *Exercitationes Duae* in 1660. *Dict. Nat. Biog.* does not state which of these treats of the magnet.

universities had resulted in a placid imperviousness on their part to the new movement of experimentation initiated by BACON. His language in this connection is fully worthy his spiritual ancestor's feelings on the same subject :

But it is not this numerous piece of monstrosity (the multitude onely) that are enemies to themselves and learning; there is a company of men amongst the philosophers themselves, a sort of notional heads, whose ignorance (though varnish'd over with a little squabling sophistry) is as great and invincible as the former. These are they that daily stuff our libraries with their philosophical romances, and glut the press with their canting loquacities. For, instead of solid and experimental philosophy, it has been held accomplishment enough to graduate a student, if he could but stiffly wrangle out a vexations dispute of some odd peripatetick qualities, or the like; which (if translated into English) signified no more than a heat t'wixt two oyster-wives in Billingsgate : nay, these crimes have not onely stain'd the common, but there are spots also to be seen even in the purple gowns of learning. For it hath been a great fault, and, indeed, a solemn piece of folly, even amongst the professors and nobler sort of philosophers, that when they have arrived to a competent height in any art or science, if any difficulty do arise that their art cannot presently reach unto, they instantly pronounce it a thing impossible to be done; which inconsiderable and rash censure and forestallment of their endevours, does not onely stifle their own further enquiries, but also hangs, to all succeeding ages, as a scar-crow to affright them for ever approching that difficulty. Hence it is, that most arts and sciences are branded at this day with some such ignominious impossibility.

Then follows an " essay " to confute the notion of the progressive decay of the world from some golden age of perfection (57). The peroration is a noble flight of rhetoric :

But these are reaches that are beyond all those of the Stagyrite's retinue, the solutions of all those former difficulties are reserved for you (most noble souls, the true lovers of free, and experimental philosophy) to gratifie posterity withall.

You are the enlarged and elastical souls of the world, who, removing all former rubbish, and prejudicial resistances, do make way for the springy intellect to flye out into its desired expansion. When I seriously contemplate the freedom of your spirits, the excellency of your principles, the vast reach of your designs, to unriddle all Nature; me-thinks, you have done more than men already, and may be well placed in a rank specifically different from the rest of groveling humanity.

And this is the age wherein all mens souls are in a kind of fermentation, and the spirit of wisdom and learning begins to mount and free it self from those drossie and terrene impediments wherewith it hath been so long clogg'd, and from the insipid phlegm and *caput mortuum* of useless notions, in which it has endured so violent and long a fixation.

This is the age wherein (me-thinks) philosophy comes in with a spring-tide; and the peripateticks may as well hope to stop the current of the tide, or (with XERXES) to fetter the ocean, as hinder the overflowing of free philosophy : me-thinks,

(57) Possibly Sloane MS 2279, art. 3, " Essay on the World's Duration."

I see how all the old rubbish must be thrown away, and the rotten buildings be overthrown, and carried away with so powerful an inundation. These are the days that must lay a new foundation of a more magnificent philosophy, never to be overthrown : that will empirically and sensibly canvass the phaenomena of Nature, deducing the causes of things from such originals in Nature, as we observe are producible by art, and the infallible demonstration of mechanicks : and certainly, this is the way, and no other, to build a true and permanent philosophy ... And to speak yet more close to the point, I think it is no rhetorication to say, that all things are artificial; for Nature it self is nothing else but the art of God. Then, certainly, to find the various turnings, and mysterious process of this divine art, in the management of this great machine of the world, must needs be the proper office of onely the experimental and mechanical philosopher. For the old dogmatists and notional speculators, that onely gaz'd at the visible effects and last resultances of things, understood no more of Nature, than a rude countrey-fellow does of the internal fabrick of a watch, that onely sees the index and horary circle, and perchance hears the clock and alarum strike in it : but he that will give a satisfactory account of those phaenomena, must be an artificer indeed, and one well skill'd in the wheel-work and internal contrivance of such anatomical engines.

V

POWER did not live long enough to get any more of his work published, dying in 1668, when only forty-five, and nothing of his appeared in the *Philosophical Transactions* (58) of the Royal Society. His " Poem in commendation of the Microscope " (59), a tantalizing title, rests among his literary remains, which still await a sympathetic editor. But on the evidence of his single book, HENRY POWER is clearly a noteworthy, if minor, writer of English, an apt and worthy disciple of his friend and master, Sir THOMAS BROWNE. In omitting from his own work ample fortification of his contentions with the Greek and Latin of his predecessors or prolix paraphrasis of them in neologistic English, as BROWNE so often did, he followed a wiser course. Even the educated man today must frequently consult a commentary to unravel the overwhelming wealth of allusion and citation in BROWNE, whereas he can read POWER with pleasurable ease for the simplicity and freshness of his beautiful but unacademic prose.

Berkeley, California. THOMAS COWLES.

(58) Begun in 1655; with the subtitle: *giving some Accompt of the present Undertakings, Studies, and Labours of the Ingenious in many considerable Parts of the World.*

(59) Sloane MS 1380, art. 16.

Un grand débat sur la physique de Malebranche au XVIII[e] siècle

1. — Les origines de la controverse.

La notion des petits tourbillons, introduite par Malebranche dans la physique cartésienne (1), n'avait pas tardé à être utilisée pour la solution de divers problèmes, en raison de la commodité même avec laquelle elle écartait certaines objections. C'est ainsi que Bouillet s'en était servi pour expliquer la pesanteur (2), et que Mazière l'avait appliquée à la question du ressort (3). Privat de Molières, après y avoir également recouru pour son *Explication physique et mécanique du choc des corps à ressort* (4), et dans son *Problème physico-mathématique, dont la solution tend à servir de réponse à une des objections de M. Newton contre la possibilité des tourbillons célestes* (5), en avait fait le principe même de ses *Leçons de physique*. Il avait ainsi demandé aux petits tourbillons de lui fournir le mécanisme fondamental du système du

(1) Voir *Réflexions sur la lumière et les couleurs*. (*Mém. de l'Académie des Sciences*, 1699) et *Recherche de la vérité*, édition de 1712, XVI[e] Éclaircissement. On consultera utilement l'important article de Duhem : *L'Optique de Malebranche* (*Rev. de Métaphysique et de Morale*, 1916, p. 37-90).

(2) Bouillet, *Dissertation sur la cause de la pesanteur*. 1 Vol., in-12°, Bordeaux, 1720. Nous avons étudié ce travail dans notre ouvrage sur *L'Introduction des théories de Newton en France au XVIII[e] siècle*. (1 Vol. gr. in-8°, Paris 1931.) § 21, *Bouillet et la théorie cartésienne de la pesanteur* (p. 89-97).

(3) Mazière, *Les lois du choc des corps à ressort parfait ou imparfait*, 1 vol. in-4°, Paris, 1727. *Traité des petits tourbillons de la matière subtile*, 1 vol. in-4°, Paris, 1727. Nous renvoyons, pour une étude de ces dissertations, à notre ouvrage précédemment cité, § 32, *le P. Mazière et la théorie des petits tourbillons*, p. 140-144.

(4) *Mémoires de l'Académie des Sciences*, 1726. Voir, sur ce point, notre ouvrage, § 33.

(5) *Mémoires de l'Académie des Sciences*, 1729. Voir encore, sur cette question, notre ouvrage § 37, *Les études de Privat de Molières sur les tourbillons*, p. 157-165.

monde, et notamment des phénomènes de la pesanteur (6), ainsi que celui de l'électricité et des réactions chimiques (7).

Dès le premier volume de ses *Leçons*, PRIVAT DE MOLIÈRES s'était préoccupé de faire apparaître la théorie des petits tourbillons comme une suite logique du système cartésien : « La substitution que nous faisons ici, avec le P. MALEBRANCHE, des petits tourbillons aux globules durs de DESCARTES, n'est pas une nouvelle hypothèse; c'est plutôt une suite du principe établi que, dès le commencement, la matière a dû être divisée et subdivisée, tant qu'il était nécessaire pour la production des effets naturels, et qui va au rabais des suppositions; puisque, au lieu du faux principe de la dureté, que nous ne considérons que comme un phénomène et un effet du mouvement, nous lui substituons une simple subdivision de la matière.

« D'ailleurs, ces petits tourbillons ayant toute la souplesse que l'on peut désirer, on voit avec évidence que les frottements que l'on craignait tant, dans le tourbillon simple, ou formé de petits globules durs, n'ont pas lieu dans le tourbillon composé de petits tourbillons élastiques, dont la souplesse fait qu'ils cèdent au moindre effort, et qu'ils prennent à chaque instant, sans se détruire, la figure convenable aux divers lieux où ils se trouvent » (8).

Sans s'arrêter pourtant aussi vite que MALEBRANCHE dans la voie ainsi ouverte, il avait, dans son mémoire de 1729, considéré comme nécessaire « de pousser plus loin son idée et d'admettre dans la division actuelle de la matière une progression à peu près semblable à celle que nos nouveaux géomètres ont reconnu dans sa divisibilité; car il est à présumer que l'Auteur de la Nature s'est procuré dans la construction de son ouvrage, s'il est possible de le faire, les mêmes avantages que l'hypothèse des infiniment petits de tous les genres procure aux géomètres de notre temps ». Par conséquent, « je supposerai, ajoutait-il, que les petits tourbillons que le P. MALEBRANCHE a substitués aux globules de DESCARTES, et que j'appellerai tourbillons du premier genre, sont

(6) *Leçons de physique*, tome I, 1733. On trouvera une analyse de ce volume dans notre ouvrage déjà mentionné, § 55, 56 et 57. Tome II, 1736 (analysé dans notre § 69).

(7) *Leçons de physique*, tome III, 1737. Nous en avons résumé les grands traits dans nos § 67 et 70.

(8) *Op. cit.*, p. 205-206.

eux-mêmes composés d'autres tourbillons incomparablement plus petits, que j'appellerai tourbillons du second genre, et qui remplissent non seulement toute la capacité des premiers, mais encore tous les espaces angulaires qu'ils laissent entre eux; et que ces tourbillons du second genre forment tous ensemble un second milieu élastique qui occupe tout l'Univers et dont les forces centrifuges et les vibrations sont autant différentes et indépendantes des forces centrifuges et des vibrations du milieu que forment les tourbillons du premier genre, que les forces centrifuges et les vibrations de celui-ci le sont de celles des grands tourbillons de DESCARTES.

« Que ces tourbillons du second genre sont encore composés de tourbillons d'un troisième genre, qui forment tous ensemble un troisième milieu élastique, qui a le même rapport au second, que le second au premier, et ainsi de suite tant qu'il sera nécessaire de pousser la division et subdivision de la matière pour rendre raison de quelque phénomène » (9).

La même idée se trouvait reprise dans les *Leçons de physique*, et PRIVAT DE MOLIÈRES y avait même précisé que ces tourbillons de divers genres ne s'excluaient pas les uns les autres d'un même espace. « Les trois éléments que nous venons de considérer, » lisons-nous dans le deuxième volume des *Leçons* (10) « peuvent former dans un même espace trois milieux différents qui rempliront chacun le même espace, sans s'exclure l'un l'autre, sans se confondre, ni se nuire dans aucune de leurs fonctions. Et dont l'élasticité du premier sera incomparablement plus forte que celle du second; et l'élasticité du second plus forte que celle du troisième ».

Peu de temps après que JEAN BERNOULLI (fils) eût vu couronner par l'Académie des Sciences son mémoire sur la propagation de la lumière (11), dont l'inspiration avait été demandée à MALEBRANCHE, BANIÈRES, dans un *Traité de la lumière et des couleurs* (12), soulevait, contre les petits tourbillons, des objections, qui, dans

(9) *Mémoires de l'Académie des Sciences*, 1729, p. 344. Les références à ces Mémoires sont faites d'après l'édition in-12° d'Amsterdam.

(10) *Leçons de physique*, II, p. 57.

(11) *Recherches physiques et géomètriques sur la propagation de la lumière*, 1 vol. in-4°, 1736. On pourra consulter, sur ce point, le § 66 de notre ouvrage déjà mentionné, p. 309-318.

(12) BANIÈRES, *Traité de la lumière et des couleurs*, 1 vol. Paris, 1737.

sa pensée, ne devaient pas d'ailleurs s'étendre jusqu'au système tourbillonnaire de DESCARTES. Mais les difficultés dépassaient néanmoins la seule explication de la lumière et, par leur généralité, atteignaient toute la théorie de MALEBRANCHE et plus spécialement celle de PRIVAT DE MOLIÈRES.

Tout en empruntant des idées à l'*Optique* de NEWTON, et en portant des appréciations élogieuses sur la méthode et le génie du grand savant anglais, BANIÈRES n'en subissait guère l'influence (13). Il n'en manifestait pas moins une opposition très nette aux explications proposées par MALEBRANCHE en optique. Spécialement, en ce qui concerne les couleurs, « le P. MALEBRANCHE, voulant prouver que la nature des couleurs dépend du plus ou du moins de promptitude des vibrations, fait le raisonnement suivant. Il est certain, dit-il, que les couleurs dépendent naturellement de l'ébranlement de l'organe de la vision; or cet ébranlement ne peut être que fort et faible, ou que prompt et lent; mais l'expérience nous apprend que le plus et le moins de la force ou de la faiblesse de l'ébranlement du nerf optique ne change point l'espèce de la couleur; ... il est donc nécessaire de conclure que c'est le plus et le moins de promptitude dans les vibrations du nerf optique, ou dans les secousses des esprits qui y sont contenus, laquelle change les espèces des couleurs, et par conséquent que la cause de ces sensations vient primitivement des vibrations plus ou moins promptes de la matière subtile qui compriment la rétine. Cet argument est assez spécieux, il paraît même solide du premier abord, mais il n'est dans le fond qu'un pur sophisme; la mineure contient un dilemme qui n'est pas dans les formes; afin que ces sortes d'argumentations soient bonnes, et qu'on puisse légitimement conclure quelque chose, il faut que l'énumération soit exacte. Le P. MALEBRANCHE devait assigner toutes les différentes impressions que le nerf optique peut recevoir, et toutes les manières différentes selon lesquelles la lumière peut agir sur cet organe, et d'où peuvent dépendre les couleurs; faute de cette exactitude, il ne peut, comme nous venons de le dire,

(13) Dans son *Examen et réfutation des Éléments de la philosophie de Newton de M. de Voltaire*, BANIÈRES se refusait à admettre la théorie de l'émission et surtout s'élevait avec force contre l'idée d'attraction. Nous nous proposons de fixer nettement la position de BANIÈRES dans le second volume de notre ouvrage sur *L'Introduction des théories de Newton en France au XVIII^e siècle*.

rien conclure de son argument; c'est ce qu'on enseigne en logique, et le bon sens autorise cette règle... » (14)

Mais BANIÈRES ne s'en tenait pas à de telles critiques, et, dès sa préface, c'était l'existence même des petits tourbillons qu'il prétendait mettre en doute dans les considérations suivantes : « L'existence des vorticules du P. MALEBRANCHE n'est pas mieux établie que celle des globules de M. DESCARTES; quelque belle et quelque ingénieuse qu'en paraisse l'invention, quelque étendu qu'on nous dise qu'est leur usage, quelques efforts qu'ait fait un grand philosophe de nos jours pour les accréditer et pour avancer leur fortune (15), on ne nous persuadera pas leur réalité; on ne nous surprendra pas par tous ces dehors spécieux, nous ne saurions admettre des corps dont la conservation ne peut s'accommoder avec les lois de la mécanique, dont la nature emporte avec soi la destruction, et dont les propriétés annoncent la ruine; ceci est manifeste, car, comme ces petits tourbillons sont des corps sphériques, ou elliptiques, comme, en un mot, ces corps sont compris sous des surfaces courbes, ils ne peuvent point se toucher immédiatement par tous les points de leur surface, ils laissent entre eux des espaces triangulaires, lesquels ne sauraient être exactement remplis par d'autres tourbillons, c'est ce qu'on conçoit distinctement; on aura beau multiplier les ordres et les espèces de ces petits tourbillons, en placer de plus petits dans les espaces que des plus grands laissent entre eux, et encore des plus petits entre les espaces que laissent ces derniers, et cela jusqu'à l'infini; tout ce qu'on gagnera par là, c'est qu'on multipliera les espaces qui deviendront plus petits et plus petits, mais ils ne seront jamais totalement remplis; d'où suit nécessairement la destruction des vorticules, car, comme ils ont une grande force centrifuge, et que chacune de leurs parties fait des grands efforts pour s'éloigner du centre de son mouvement, ces parties s'échapperont par ces petits espaces dont nous venons de parler et du côté desquels ils ne sont pas repoussés ni contrebalancés; de là, leur mouvement circulaire cessera et le petit tourbillon

(14) *Op. cit.*, p. 312-314.

(15) PRIVAT DE MOLIÈRES, dans le tome III de ses *Leçons de physique* (p. 450) indiquait, dans une note, qu'il fallait voir là très probablement une allusion à JEAN BERNOULLI, dont le mémoire sur la lumière venait d'être couronné par l'Académie des Sciences, en 1736.

sera détruit, ce qui arrivera dans tous les points de l'espace qu'on dit être rempli par ces petits tourbillons, puisque le même inconvénient se trouve dans tous les points de cet espace. Rien de plus simple ni de mieux prouvé que cette vérité : les vorticules sont des corps compris sous des surfaces courbes, ils ne se touchent donc pas les uns les autres par tous les points de leur surface; encore, les parties de ces petits tourbillons sont détachées et ont un grand mouvement circulaire; elles font donc effort pour s'écarter du centre de leur mouvement, et elles doivent en effet s'en écarter, moins elles rencontrent de tous côtés des obstacles insurmontables; mais elles ne rencontrent point d'obstacle du côté par lesquels ces petits tourbillons ne se touchent pas, elles s'échapperont donc par ce côté, le petit tourbillon sera ainsi détruit; il n'y a aucune de ces propositions qu'on ne puisse démontrer, ou, pour mieux dire, qui n'ait été géométriquement démontrée, tout le monde en reconnait la certitude » (16).

La réponse à cette objection ne se fit pas attendre et, dans le troisième volume de ses *Leçons de physique*, paru la même année. PRIVAT DE MOLIÈRES continuait la discussion sur ce point. Il faisait d'abord remarquer, à propos de la subdivision des espaces angulaires en d'autres petits tourbillons, chez MALEBRANCHE, que « quoique cette subdivision soit seule capable d'anéantir cette difficulté (il s'agit de celle qu'élevait BANIÈRES) à laquelle le P. MALEBRANCHE n'a pas seulement pensé, ce n'est pas certainement pour y répondre, mais pour un dessein bien plus important qu'il l'a imaginée » (17).

Sur l'objection elle-même, il répliquait que les points composant les petits tourbillons ne devaient pas, malgré leur grande force centrifuge, s'échapper à travers les espaces angulaires; « cela par

(16) *Op. cit.* Préface, p. XLIV-XLVIII.

(17) *Leçons de physique*, III, p. 453-454. Si PRIVAT DE MOLIÈRES cherchait à faire apparaître les intentions de MALEBRANCHE, c'est qu'il considérait que BANIÈRES mettait quelque parti-pris à s'attaquer au fondateur de la doctrine des petits tourbillons. « C'est surtout, écrivait-il un peu plus loin (p. 461) au P. MALEBRANCHE, qui, de l'aveu de toutes les nations, est celui qui a délivré la philosophie entière de plus d'erreurs, à qui il adresse ses traits les plus piquants. D'abord il le rend responsable de toutes les opinions communément reçues de son temps, comme si elles lui étaient particulières, et dont il ne fait usage que pour nous communiquer ses idées et détromper les cartésiens, par leurs propres principes, de certaines erreurs capitales dans lesquelles il les voyait engagés ».

cette raison purement mécanique : que les points qui forment les tourbillons environnants ne peuvent entrer dans les espaces angulaires qu'ils laissent entre eux, à moins que la matière dont ces espaces sont remplis, et qui ne laisse pas d'être impénétrable, quoiqu'elle n'ait pas acquis la forme de tourbillon, ne sorte de ces espaces. Or la matière qui remplit ces espaces angulaires ne peut en sortir par la raison : que tout est plein. Car apparemment l'auteur qui dispute contre le P. MALEBRANCHE lui accorde le premier principe des cartésiens et des péripatéticiens : qu'il n'y a point de vide dans la nature; sans quoi tout son discours ne porterait sur rien.

« D'ailleurs, quoique la matière contenue dans les espaces angulaires soit fortement poussée d'un côté par l'effort centrifuge d'un des tourbillons qui l'environnent, elle n'est pas moins fortement poussée de tous les autres côtés par tous les autres tourbillons; ce qui doit nécessairement produire l'équilibre, et par conséquent la destruction de tous ces efforts contraires, qui se balanceront nécessairement » (18).

Après avoir montré comment ces idées s'opposaient exactement aux conclusions de BANIÈRES tirées de la non-résistance des espaces angulaires à l'effort des petits tourbillons, PRIVAT DE MOLIÈRES insistait, en soutenant au contraire « que les particules de ces petits tourbillons rencontrent de grands obstacles : l'impénétrabilité de la matière contenue dans ces angles — l'impossibilité que cette matière en sorte à cause que tout est plein — le balancement mutuel des forces contraires des tourbillons environnants, qui fait que ces forces se détruisent à chaque instant, et qu'elles laissent en repos les particules de la matière contenues dans ces angles. Que par conséquent ces particules du petit tourbillon ne s'échapperont pas par ce côté. Que le petit tourbillon ne sera donc pas ainsi détruit. Qu'il n'y a aucune de ces propositions, contradictoires à celle de l'auteur, qu'on ne puisse démontrer, ou, pour mieux dire, qui n'ait été géométriquement démontrée. Que tout le monde en a toujours reconnu la certitude; par la raison que personne avant lui ne s'était avisé de faire une objection si frivole contre la possibilité du mouvement circulaire dans le

(18) *Op. cit.*, p. 455-456.

système du plein, et qu'enfin l'auteur n'a pas raison de chanter si haut victoire » (19).

PRIVAT DE MOLIÈRES ne se contentait pas de répondre ainsi directement à l'objection de BANIÈRES; il profitait de cette occasion pour rappeler la nécessité d'admettre, dans l'hypothèse du plein, le mouvement tourbillonnaire. En effet « presque généralement toutes les moindres particules de la matière étant dans un très grand mouvement (mouvement que toutes les expériences de la chimie prouvent invinciblement), il n'est pas possible que, dans le système du plein, toutes ces particules continuent à se mouvoir en tous sens en lignes droites. D'où il suit que c'est une nécessité absolue d'admettre le mouvement circulaire dans la nature » (20).

Puis, se plaçant plus spécialement sur le terrain de l'optique, il affirmait « que c'est contre la raison de dire que les petits tourbillons n'existent pas, parce qu'on peut se passer de leur existence dans l'explication de la lumière, en supposant que les rayons sont composés de petits corps durs élastiques, sans se mettre en peine d'où peut procéder cette élasticité, laquelle néanmoins est une propriété évidemment inséparable du tourbillon » (21).

L'opposition des idées, sinon la discussion, entre PRIVAT DE MOLIÈRES et BANIÈRES n'en devait pas rester là; mais, dès l'année 1739, elle se trouvait plus restreinte au domaine de l'optique. Certes BANIÈRES, dans son *Examen et Réfutation des Éléments de la philosophie de Newton par M. de Voltaire* (22), faisait bien encore remarquer, à propos de JEAN BERNOULLI, (fils), que « le système des petits tourbillons qu'il embrassa demandait qu'il pensât ainsi » et ajoutait que « d'autres ont eu recours à d'autres principes qui ne sont ni plus solides, ni plus certains » (23). Mais,

(19) *Op. cit.*, p. 457-458.

(20) *Op. cit.*, p. 459. Il allait jusqu'à se considérer par là autorisé à écarter, de façon préjudicielle et sans examen, les difficultés que l'on pourrait être tenté de formuler. « Par conséquent, continuait-il, toutes les objections que l'on peut former contre l'existence de ce mouvement ne peuvent être que mal fondées ».

(21) *Op. cit.*, p. 459-460. D'ailleurs « lorsqu'on entreprend d'expliquer un phénomène, il ne faut pas le considérer comme si c'était le seul effet que la nature a produit, ni qu'il puisse être expliqué aux dépens de l'explication de tous les autres » (*Op. cit.*, p. 460).

(22) Le titre même de l'ouvrage indique qu'à ce moment les préoccupations scientifiques de BANIÈRES n'étaient plus les mêmes, et qu'il s'agissait alors pour lui de critiquer les explications newtoniennes proposées par VOLTAIRE.

(23) *Op. cit.*, préface, p. LXXXV-LXXXVI.

sans renouveler ses attaques directes contre les petits tourbillons (24), il opposait surtout sa théorie de la lumière à celle de MALEBRANCHE. « Le P. MALEBRANCHE, remarquait-il, a raisonné des couleurs comme on raisonnait des tons, et, sans s'embarrasser de ce qu'il y avait de plus essentiel dans la question, il a cru que la différence des couleurs dépendait du plus ou du moins de promptitude dans les vibrations des rayons qui portaient les couleurs. Il nous a dépeint l'état réel des rayons hétérogènes, mais il ne nous a point indiqué ce qui procurait un semblable état à ces rayons. Il nous a dit que les rayons qui portaient les différentes couleurs étaient différents entre eux, mais il n'a point parlé de la cause originaire de ces différences. Il a cru que toute sorte de rayons pouvaient porter toute sorte de couleurs, et que toute sorte de parties de lumière pouvaient entrer indifféremment dans la composition de toute sorte de rayons, comme on a cru jusques ici que toute sorte de molécules d'air peuvent entrer dans la composition de toute sorte de fibres sonores, et qu'un même rayon sonore peut porter tantôt un ton, et tantôt un autre ton; pour nous, nous avons raisonné sur des principes tout différents. Le P. MALEBRANCHE, enfin, n'a point expliqué la cause qui fait qu'un rayon fait ses vibrations plus ou moins promptes qu'un autre rayon, ou, s'il l'a fait, il s'est trompé en faisant dépendre les couleurs des corps et non des rayons : selon lui, ce sont les corps qui colorent les rayons, tandis que, suivant notre hypothèse, ce sont les rayons qui colorent les corps; nous avons enfin donné une cause mécanique de la différente promptitude des rayons de différente espèce, et c'est ce qu'on peut dire qui manquait au système ingénieux du célèbre M. NEWTON » (25).

La même année, PRIVAT DE MOLIÈRES présentait, dans le quatrième volume de ses *Leçons de physique*, une théorie de la lumière inspirée de MALEBRANCHE et dans laquelle les petits tourbillons jouaient un rôle important. « Nous ne voyons aucun inconvénient,

(24) Sa position cartésienne dans la recherche d'une explication mécanique des phénomènes de la réflexion et de la réfraction et sa défense des grands principes cartésiens de l'impulsion et du plein contre l'attraction et le vide devaient d'ailleurs lui faire apparaître comme gênante une critique trop poussée des petits tourbillons, en raison de la tendance que pourraient avoir les lecteurs à l'étendre jusqu'au système tourbillonnaire en général.

(25) *Op. cit.*, préface, p. LXXXIV-LXXXV.

proposait PRIVAT DE MOLIÈRES, (26) de penser, avec M. HUYGENS, que la lumière se transmette dans la matière éthérée à peu près de la même façon que le son se transmet dans l'air, ni qu'il soit nécessaire de penser que c'est la molécule voisine du soleil qui vienne elle-même frapper le fond de nos yeux plutôt qu'une molécule pareille qui est actuellement contre le fond de notre œil, et à laquelle la molécule voisine du soleil a transmis son action, qui frappe notre rétine ». Et, après avoir expressément rejeté l'hypothèse newtonienne de l'émission, il estimait pouvoir répondre à toutes les objections et écarter toutes les difficultés. Notamment, en ce qui concerne la promptitude de propagation de la lumière, elle est bien loin d'être inconcevable, si l'on tient compte de ce que les globules de l'éther sont formés de petits tourbillons extrêmement petits et par conséquent doués d'une très grande force centrifuge. Les petits tourbillons de l'air, qui transmettent le son, sont beaucoup plus gros, et de là la vitesse de propagation beaucoup moindre.

Puis, après avoir appliqué les explications mécaniques à la réflexion et à la réfraction de la lumière, en en tirant spécialement l'égalité des angles d'incidence et de réflexion et le rapport constant des sinus des angles de réfraction et d'incidence, PRIVAT DE MOLIÈRES continuait : « L'inflexion que les rayons de lumière souffrent soit à la rencontre des corps opaques, soit à l'entrée et à la sortie des corps tranparents, ne nous oblige en aucune sorte d'avoir recours à l'attraction, ni au vide. Mais elle nous indique qu'il y a toujours, sur la superficie des corps opaques et transparents, de petites atmosphères formées de petits tourbillons qui ont un globule dur à leurs centres, et dont la densité va en diminuant en s'éloignant du corps » (27).

Enfin « le phénomène des couleurs dont la lumière est composée, et que M. NEWTON a découvert avec une sagacité merveilleuse, est, poursuivait encore PRIVAT DE MOLIÈRES (28), une suite naturelle de la théorie que nous venons d'établir ».

Et, dans une conclusion générale, il résumait les traits essentiels de son système, en insistant sur la fécondité de l'explication

(26) *Leçons de physique*, IV, p. 472.
(27) *Op. cit.*, p. 519.
(28) *Op. cit.*, p. 531.

générale de la nature par les lois du mouvement circulaire. « Je n'ai point fait d'hypothèse, ajoutait-il (29), en disant : que les moindres parties de la matière ont toutes, dès le commencement, reçu immédiatement de Dieu un mouvement orbiculaire qui les a transformées en tourbillons à peu près sphériques; ayant démontré que ce mouvement était le seul qui puisse être permanent dans le système du plein. De sorte que ce n'est qu'étendre le même principe de dire : que Dieu a ensuite formé, de l'amas de ces très petits tourbillons, des tourbillons beaucoup plus grands et, de ceux-ci, des tourbillons encore beaucoup plus grands que les précédents, et ainsi de suite ».

Il pouvait sembler dès lors qu'adversaire et partisan de MALEBRANCHE, tout en restant chacun sur ses positions, allaient abandonner la discussion et laisser tomber une polémique à laquelle aucun argument nouveau, d'un côté ou de l'autre, n'apportait plus d'éléments. Mais celle-ci se ranima bientôt dans des circonstances, qui, en lui imposant une tournure un peu différente, ne lui firent rien perdre de son caractère. Nous avons vu en effet que jusque là elle s'était développée entre cartésiens, puisque BANIÈRES, pas plus que PRIVAT DE MOLIÈRES, ne songeait à rejeter l'explication cartésienne de l'univers; dans sa pensée, la négation des petits tourbillons ne devait pas impliquer l'abandon de l'hypothèse tourbillonnaire. Il n'en était plus de même dans l'esprit de SIGORGNE.

2. — LA REPRISE DU DÉBAT

Les *Leçons de physique* de PRIVAT DE MOLIÈRES, dont la publication s'était achevée ainsi, en 1739, avec le quatrième volume, étaient, en 1740, le plus récent et le meilleur exposé d'ensemble d'une physique d'inspiration cartésienne. Il pouvait donc paraître à un newtonien que la meilleure manière de lutter contre le cartésianisme était précisément d'en aborder la critique par cette voie. La méthode était un peu détournée certes, puisque PRIVAT DE MOLIÈRES était, plus encore que le disciple de DESCARTES, celui de MALEBRANCHE; mais, en poussant jusqu'à son extrême limite

(29) *Op. cit.*, p. 568.

la notion de tourbillon, il fournissait aussi des armes à qui voulait montrer les difficultés de cette notion; peut-être, de ce point de vue, la méthode la plus simple consistait-elle à s'attaquer indirectement aux grands tourbillons par l'intermédiaire des petits et à atteindre DESCARTES à travers MALEBRANCHE. Ce fut au moins la façon dont SIGORGNE envisagea la question, lorsqu'il publia, au début de l'année 1741, son *Examen et réfutation des Leçons de physique expliquées par M. de Molières au Collège Royal.* Dès les premières pages de son Avertissement, conformément à la tactique sur laquelle nous venons de dire quelques mots, il considérait comme une heureuse circonstance pour la physique l'attitude de PRIVAT DE MOLIÈRES à l'égard des tourbillons.

« Je crois, disait-il, que M. DE MOLIÈRES a rendu un service important à la physique, en approfondissant et débrouillant, comme il l'a fait, l'idée des tourbillons que ni DESCARTES, ni même le P. MALEBRANCHE, leur premier réformateur, n'avaient pas assez développée. » Mais ce n'était là qu'une manière d'amorcer la discussion et d'ouvrir la voie aux critiques. « Personne, continuait-il, n'ignore l'origine, la nature et les fonctions des trois éléments de DESCARTES; il a plu à l'auteur des *Leçons de Physique* d'en conserver le nombre et de leur attribuer les mêmes fonctions. Mais il s'en faut bien qu'il demeure d'accord de leur nature et de leur origine. Il ne veut point de matière globuleuse, c'est-à-dire de cette matière dure et sans pores, dont DESCARTES remplissait ses grands tourbillons; la matière subtile, telle qu'on la conçoit ordinairement, n'est pas plus de son goût. Il veut que la matière ait d'abord été divisée en une infinité de tourbillons; de sorte que ses trois éléments sont des tourbillons de différents ordres. Le premier ordre est composé de tourbillons très petits, et c'est la matière subtile, ou le premier élément. L'éther destiné à remplir les grands tourbillons et à être le véhicule de la lumière est composé de tourbillons du premier élément qui tournent autour d'un centre commun; enfin l'air où le troisième élément est formé par des tourbillons du second qui circulent autour d'un globule dur comme centre. Ces trois éléments, selon notre savant auteur, se trouvent dans le même lieu sans se confondre ni se nuire en quoi que ce soit, et un tourbillon du premier élément peut devenir tourbillon du second, comme celui-ci du troisième et réciproquement.

« On ne peut nier que cette transformation des éléments de

DESCARTES en petits tourbillons ne soit d'une belle et magnifique invention. Mais cela ne suffit pas en Physique, et M. BANIÈRES, dans la préface du *Traité de la lumière et des couleurs* qu'il a donné au public, a fait contre les petits tourbillons une difficulté très réelle et qui vient naturellement à l'esprit de tout homme de bon sens pour peu qu'il veuille réfléchir. »

En renouvelant cette objection de BANIÈRES contre les petits tourbillons, SIGORGNE ne s'attaquait plus seulement à PRIVAT DE MOLIÈRES, mais aussi à MALEBRANCHE; et, dépassant de beaucoup la pensée de BANIÈRES, il prétendait par là s'attaquer au cartésianisme même, que BANIÈRES avait cru pouvoir maintenir malgré tout. Son attitude était d'ailleurs, sur ce point, plus logique que celle de BANIÈRES, car la question de l'influence des espaces angulaires sur la destruction des tourbillons se posait aussi bien à propos des grands qu'en ce qui concerne les petits.

Faisant allusion à la réponse apportée par PRIVAT DE MOLIÈRES, il visait plus particulièrement d'abord ce qu'avait dit celui-ci du rôle demandé par MALEBRANCHE aux petits tourbillons, leur utilité ne consistant pas, dans la doctrine du maître, à combler les espaces angulaires laissés par de plus grands entre eux : « Ce n'est point, dit M. DE MOLIÈRES, pour obvier à cette difficulté, ni pour y répondre, mais pour un dessein bien plus important que le P. MALEBRANCHE a subdivisé les espaces angulaires que les tourbillons laissent nécessairement entre eux en d'autres petits tourbillons; puisque le disciple est toujours un bon interprète des intentions du maître, nous devons en croire M. DE MOLIÈRES et j'en demeure volontiers d'accord; mais que cette subdivision soit seule capable, comme il l'avance sans preuve, d'anéantir la difficulté, c'est de quoi il me permettra de douter. Qu'il multiplie, s'il le juge à propos, ses tourbillons à l'infini; chaque tourbillon laissant avec son voisin un espace libre, les espaces seront ainsi multipliés à l'infini. Et s'il y a des infinis plus grands les uns que les autres, ainsi que notre auteur ne fait point de difficulté d'en admettre même comme le principal fondement de sa physique, il me paraît que le nombre infini d'espaces doit être plus grand que celui des tourbillons qu'on emploierait pour les remplir ». On voit comment, de la question de l'intention chez MALEBRANCHE, SIGORGNE entraînait le problème sur le fond même, à savoir la possibilité ou non de concilier l'existence des petits tourbillons

avec celle des espaces angulaires, nécessairement impliqués par eux, comme par les grands.

« Concevons, poursuivait-il, trois petits globes qui se touchent, ils laissent entre eux un espace vide; si dans cet espace on met un autre globule plus petit que les précédents qui cependant soit assez gros pour les toucher, il est clair qu'au lieu d'un espace qu'il y avait, il y en aura trois, dont chacun à la vérité sera plus petit que le précédent, mais il n'importe.

« Maintenant, si à chacun de ces trois espaces on met un petit globe, comme on l'a fait au premier, chacun de ces globules formera trois espaces, et, au lieu de trois qu'il y avait auparavant, il y en aura trois fois trois, c'est-à-dire neuf. Si l'on continue à loger dans chacun de ces espaces des globules encore plus petits, on conçoit distinctement que chacun de ces globules ou petits tourbillons donnera trois espaces; d'où il suit que, si, pour remplir l'espace formé par trois tourbillons, on multiplie et subdivise par conséquent ces tourbillons à l'infini, ils donneront un nombre infini d'espaces constamment plus grand; et, par une suite nécessaire, cet espace ne pourra jamais être rempli par d'autres tourbillons quelque petits qu'on veuille les supposer. Que l'Auteur ne nous dise donc plus que cette subdivisoin est seule capable d'anéantir la difficulté; elle la laisse dans son entier ».

Sigorgne considérait d'ailleurs comme introduit par opportunité polémique ce raisonnement de Privat de Molières établissant que, bien loin de créer la difficulté tirée de l'existence des espaces angulaires, les petits tourbillons étaient seuls au contraire de nature à la faire disparaître, en apportant un moyen de combler ces espaces sans s'y dissiper eux-mêmes. Sans développer plus longuement ses remarques sur ce point, il arrivait donc à l'examen de la réponse essentielle, à savoir la résistance opposée par les espaces angulaires aux petits tourbillons, résistance capable d'empêcher la dissolution de ceux-ci par leur force centrifuge. Or, en plaçant, pour expliquer cette résistance, une matière impénétrable dans les espaces angulaires, Privat de Molières se trouvait, de l'avis de Sigorgne, en contradiction avec lui-même. « Cette réponse, rappelait-il, consiste à dire, sans le prouver, que les petits tourbillons ne s'échapperont point à travers les espaces qu'ils forment entre eux, parce que ces espaces seront remplis d'une matière impénétrable qui, n'ayant pas acquis la

forme de tourbillons, s'accommodera à la figure de ces espaces sans pouvoir en sortir ».

« Mais, répliquait-il, peut-on être si peu d'accord avec soi-même ? que l'Auteur relise la prop. XV, leçon IV de son Livre, elle lui fournira la réfutation expresse de sa réponse. Cette proposition dit que « dans un tourbillon composé de petits tourbillons, si, à quelle distance qu'on voudra de son centre, on pose un mobile dont les parties ne soient pas de petits tourbillons, quoiqu'il y circule aussi vite qu'un pareil volume de matière qui est en tourbillons, il pèsera et s'approchera continuellement du centre du grand tourbillon ». Or cette matière qu'il loge dans les angles n'est point en petits tourbillons, c'est le fondement de sa réponse; elle est dans un grand tourbillon, composé de petits tourbillons; c'est là son système. Il est donc absolument nécessaire que cette matière s'approche continuellement du centre du grand tourbillon, et qu'elle quitte les espaces angulaires où la réponse veut l'emprisonner. Cela me paraît démonstratif, et je ne sais pas ce que l'Auteur pourrait opposer à cette application de ses propres principes ».

« Ce serait en vain, ajoutait SIGORGNE, qu'on aurait recours à une parfaite plénitude pour empêcher ce corps de descendre et d'abandonner ces espaces; tout est également plein lorsqu'un corps terrestre se trouve au milieu de l'air ou de l'éther, et cependant cette parfaite et exacte plénitude n'empêche en rien la chute de ce corps, et nous n'avons pas encore vu qu'un boulet de canon se soit avisé de rester suspendu en l'air, quoiqu'il se trouve de toutes parts environné de petits tourbillons.

« Dira-t-on que le balancement des petits tourbillons empêche cette matière de sortir des espaces angulaires et de s'acheminer vers le centre du grand tourbillon ? Cette réponse peut être bonne en elle-même, et elle sera dans la suite une difficulté contre une proposition de cette physique; mais elle ne peut avoir lieu dans les principes de M. DE MOLIÈRES par la raison que j'ai déjà dite, savoir que ce balancement est le même par rapport à un corps terrestre qui se trouve entre ces petits tourbillons, et qui ne laisse pas néanmoins de tomber au centre, comme il le ferait dans le vide, par la loi de l'attraction. Y aurait-il un privilège pour cette matière anguleuse, une raison particulière de la descente du corps terrestre ? Je n'en aperçois point. Voici ce que je lis

dans la remarque qui suit immédiatement la proposition citée : « A la vérité un mobile qui, même, ne serait pas en petits tourbillons ne s'approcherait pas du centre, quoiqu'il fût placé entre des petits tourbillons, si ces petits tourbillons ne faisaient partie d'un grand; parce qu'alors le corps serait également pressé partout à cause que les petits tourbillons, ne circulant pas autour d'un centre commun, ne tendraient pas à se mouvoir plus fortement vers un point que vers un autre; d'où il suit qu'il resterait au lieu où on l'aurait posé. Mais si ces petits tourbillons qui entourent le corps solide forment un grand tourbillon, alors le corps solide, ayant moins de force centrifuge qu'un pareil volume d'éther, s'approchera continuellement du centre du grand tourbillon. Ce qui est, à ce qu'on nous dit, d'une évidence parfaite ».

« Or les petits tourbillons entre lesquels se trouve la matière dont il s'agit tournent autour d'un centre commun : ils font partie d'un grand tourbillon, et ils tendent à se mouvoir plus fortement vers un point que vers un autre; la matière anguleuse ne peut donc être également pressée de toutes parts, et ayant, selon l'Auteur, moins de force centrifuge qu'un pareil volume de petits tourbillons, elle doit descendre et forcer les portes de sa prison. D'ailleurs, quand il souffle un grand vent, qu'un tourbillon est englouti par un autre, qu'une comète traverse en sens contraire la matière d'un tourbillon, est-ce que cette matière ne devrait pas tomber au centre et quitter les espaces angulaires? Il me paraît qu'alors, n'étant plus soutenue par les tourbillons inférieurs, elle sera précipitée par sa pesanteur. De même, quand les petits tourbillons s'agrandiront et que leurs pores deviendront par conséquent plus grands, comment seront-ils entièrement remplis? Quand au contraire ils diminueront de volume et que leurs pores ou les espaces qu'ils laissent entre eux se rétréciront, pourquoi cette matière n'en sera-t-elle pas chassée par le mouvement circulaire des petits tourbillons? « A mesure, dit l'Auteur, p. 442, t. 2, que l'eau deviendra froide, et que ses pores se rétréciront, les molécules des sels, ne pouvant plus être contenues dans les pores de l'eau, en seront chassées par le seul mouvement circulaire des molécules de l'eau; et elles se précipiteront au fond du vase ». Il doit donc en arriver autant à la matière angulaire, elle ne peut longtemps être resserrée dans les angles que les petits tourbillons laissent entre eux, si même elle peut y demeurer

un seul instant. On ne peut se refuser à cette conséquence, puisque ce serait tout à la fois renoncer à l'explication de la pesanteur et des précipitations chimiques » (30).

Accorderait-on d'ailleurs à PRIVAT DE MOLIÈRES l'impossibilité, pour la matière angulaire, de s'échapper des espaces dans lesquels elle se trouve enfermée, que toutes les difficultés ne seraient pas ainsi dissipées. Encore faudrait-il que cette matière soit en repos. PRIVAT DE MOLIÈRES considérait que ce repos devait être assuré, malgré les efforts continuels des petits tourbillons environnants, parce que ces efforts, étant opposés, devaient se détruire. « Mais il me semble, répondait SIGORGNE, que, selon la prop. V de l'auteur, leçon troisième, cette matière devait bientôt faire partie des tourbillons qui l'environnent; parce que chacun de ces tourbillons s'emparera de quelques-unes de ses particules et les fera circuler autour de son centre, comme nous voyons que l'air s'empare de petits corps et les fait pirouetter sur sa superficie. Je veux bien encore que toute cette matière ne soit point enlevée par les tourbillons voisins, cela ne diminue point la difficulté; parce que de cette supposition il suit que cette matière est diminuée, et que les tourbillons sont augmentés; or, plus les tourbillons sont grands, plus aussi faut-il de matière pour remplir les espaces angulaires qu'ils laissent entre eux, et cependant, par la supposition, il s'en trouve en ce cas moins qu'auparavant; c'est donc une nécessité de penser que, quelque tour qu'on donne à la chose, les espaces angulaires formés par les petits tourbillons ne seront jamais exactement remplis; je ne vois pas au moins ce qu'on pourrait opposer de solide à cette conséquence. Car de répondre que les parties de cette matière angulaire sont liées et composent ensemble un corps dur, c'est évidemment supposer la question. D'où viendrait en effet la liaison de ces parties? Ce ne serait point de leur repos les unes auprès des autres, l'auteur convient que le repos n'est pas une force; elle viendrait donc de la compression des tourbillons, auquel cas il est clair qu'au premier moment que les tourbillons ont existé, cette matière n'était pas encore dure : ce n'est point par conséquent la solidité et la liaison de ces parties qui aurait empêché les tourbillons, qui tendent continuellement

(30) *Op. cit.*, p. XIV-XIX.

à s'épaissir, de s'agrandir, dans ce premier instant, aux dépens de cette matière » (31).

A cette objection concernant les espaces angulaires, empruntée à BANIÈRES, mais développée avec une force nouvelle, SIGORGNE ajoutait d'autres difficultés. L'une d'elles consistait à tirer l'impossibilité des tourbillons quels qu'ils soient, simples ou composés, de la nécessité pour eux de faire leurs révolutions selon des lignes de circulation formant des courbes rigoureuses. « Car, si les circonférences où circulent les points d'un tourbillon ne sont pas exactement rondes, il y aura plusieurs enfoncements et plusieurs monticules, tant dans ces circonférences, ou plutôt dans ces superficies sphériques, que dans les points de ce tourbillon » (32). Dès lors « il ne peut se faire que les points de la couche inférieure, faisant leurs révolutions, ne viennent à rencontrer quelqu'une des élévations de la couche supérieure; or, parce que tout est plein et que ces points ont d'ailleurs une grande force centrifuge, ils ne pourront descendre au dessous de cette éminence pour continuer leurs circulations. Il leur faudra donc s'arrêter ou rompre cet obstacle et rendre par ce moyen la superficie entièrement sphérique. Or, c'est une vérité unanimement reconnue aujourd'hui de tous les physiciens, que le cercle parfait est impossible parce qu'il est incompatible avec la nature de l'étendue et l'on peut voir partout les démonstrations qu'ils en donnent » (33).

Ce qui paraissait impossible également à SIGORGNE, c'était l'équilibre entre les petits tourbillons. En effet « si un tourbillon contenu dans un espace rempli de tourbillons a plus de force centrale que ceux qui l'environnent, il s'étendra continuellement aux dépens des tourbillons voisins, et il n'y aura pas moyen que l'équilibre survienne entre ces tourbillons » (34). De plus « dans un tourbillon composé, si la vitesse avec laquelle les petits tourbillons supérieurs circulent autour de leurs propres centres est plus grande par rapport à celle des inférieurs qu'elle ne doit l'être; la vitesse des supérieurs pourra bien passer aux inférieurs et se transmettre de la superficie au centre, mais non pas du centre dans les couches du grand tourbillon jusqu'à la superficie, et il

(31) *Op. cit.*, p. XIX-XXI.
(32) *Op. cit.*, p. XXIII.
(33) *Op. cit.*, p. XXIV.
(34) *Op. cit.*, p. 97.

n'y aura pas moyen que l'équilibre survienne entre ces petits tourbillons » (35). Enfin « dans un tourbillon sphérique composé, si l'on veut, de petits tourbillons, les frottements retarderont les mouvements circulaires de ses points autour de son centre; et le tourbillon ne pourra demeurer perpétuellement dans le même état » (36).

En prenant encore sous un autre angle la question des petits tourbillons, SIGORGNE voyait, dans l'affirmation de leur existence, la nécessité de reconnaître « que chaque petit tourbillon, même infiniment petit, doit être composé d'une infinité d'autres tourbillons plus petits ». En effet « l'auteur avoue que, dans le tourbillon simple, les frottements doivent empêcher les mouvements circulaires et les détruire même après quelque temps; il est donc nécessaire, pour qu'un grand tourbillon puisse subsister, que les points qui le composent soient eux-mêmes composés d'autres petits tourbillons à l'infini : car, si les parties d'un tout viennent à se détruire, le tout ne peut manquer d'être lui-même détruit. D'où viendrait d'ailleurs la dureté des points qui composeraient un de ces petits tourbillons? On ne pourrait en assigner aucune cause. Il est donc indubitable que, dans les principes de l'auteur, qui sont sur ce point très conformes au mécanisme, il faut admettre, non seulement dans l'univers entier, mais dans le moindre petit tourbillon, une infinité d'autres tourbillons plus petits qui en contiendront encore chacun une infinité. Voilà où conduit le système des tourbillons; je ne puis comprendre comment un système fondé sur le paradoxe de l'infini actuel peut prendre racine et faire fortune; certainement il n'est point aisé de se familiariser avec ce principe. La matière est divisible à l'infini, je le veux, mais de cela seul ne s'ensuit-il pas qu'elle ne saurait être autant divisée actuellement qu'elle est divisible, puisque l'infini ne peut pas s'épuiser? Il le serait cependant dans l'hypothèse du tourbillon, on vient de le voir, et l'on pourrait en apporter quantité d'autres preuves. M. DE MOLIÈRES ne peut donc plus nous déguiser cette conséquence nécessaire de ses principes, vu surtout que M. DE GAMACHES, qui soutient le même système, vient de lever le masque et d'admettre cette division et subdivision

(35) *Op. cit.*, p. 125.
(36) *Op. cit.*, p. 137.

des tourbillons, que M. DE MOLIÈRES n'évitait avec tant de soin que de crainte d'alarmer les esprits » (37).

Avec SIGORGNE, ce n'étaient donc plus seulement les petits tourbillons dont l'existence était contestée, mais le système tourbillonnaire tout entier qui se trouvait attaqué. La polémique n'était plus seulement engagée entre cartésiens; elle débordait sur le domaine beaucoup plus large des discussions depuis longtemps déjà ouvertes entre cartésiens et newtoniens. Il serait facile, mais hors du cadre de cette étude, de relever les nombreuses références à NEWTON faites par SIGORGNE au cours de ses exposés; l'esprit newtonien s'affirmait d'un bout à l'autre de l'ouvrage, et SIGORGNE ne manquait pas une occasion d'insister sur la supériorité des explications attractionnaires (38).

3. — L'ÉLARGISSEMENT DE LA POLÉMIQUE

« *L'Examen des Leçons de physique*, n'est précisément qu'un ramas d'objections, écrivait PRIVAT DE MOLIÈRES (39). Son auteur n'y établit aucun principe; au contraire il les renverse tous; de sorte que, si l'on suit ses idées, il n'y aura plus de physique ». Si donc PRIVAT DE MOLIÈRES n'entreprit pas lui-même de répondre à SIGORGNE, il engagea à le faire LE CORGNE DE LAUNAY, qui publia, la même année, une *Réponse aux principales objections contenues dans l'Examen des Leçons de physique*. Dans un avertissement, il prévenait le lecteur des motifs de son intervention dans le débat. « Parmi les partisans du système des petits tourbillons, écrivait-il, on trouvera bien des physiciens plus habiles que moi, mais je doute qu'on en puisse trouver de plus zélés » (40).

(37) *Op. cit.*, p. 182-183. L'ouvrage de DE GAMACHES auquel il est fait ici allusion est son *Astronomie physique ou Principes généraux de la nature appliqués au mécanisme astronomique et comparés aux principes de la philosophie de Newton*, Paris, 1740.

(38) Nous étudierons spécialement ce point dans le tome II, actuellement en préparation, de notre ouvrage sur *L'introduction des théories de Newton en France au XVIII^e siècle*.

(39) *Letre de l'auteur des Leçons de physique à M.* (du 16 février 1741) insérée par LE CORGNE DE LAUNAY, en tête de sa *Réponse aux principales objections contenues dans l'Examen des Leçons de physique de M. l'abbé de Molières*, 1 vol. in-12°, Paris, 1741, p. IV.

(40) *Op. cit.*, p. XIV.

Sur la question des espaces angulaires, LE CORGNE DE LAUNAY estimait faux « qu'il y ait des espaces vides à remplir, parce que, même avant la formation des petits tourbillons tout était plein; donc ces espaces sont encore remplis d'une matière impénétrable; donc aussi il est faux de dire que les efforts dilatatifs des petits tourbillons ne seront point contrebalancés. Chacun de ces tourbillons fait le même effort pour s'étendre, mais ces espaces étant remplis d'une matière impénétrable, elle contrebalancera tous ces efforts, je veux dire que les particules dont les petits tourbillons sont formés ne pourront s'échapper à travers ces espaces, par la raison que ces espaces sont pleins d'une matière impénétrable, qui, étant également poussée de tous côtés, est par conséquent obligée de rester où on l'a mise » (41). Puis, après avoir remarqué sans insister, que la subdivision des petits tourbillons, en admettant « qu'on pousse ainsi la chose jusqu'à l'infini », réduirait le vide supposé à un infiniment petit, il passait à l'examen de la difficulté par laquelle SIGORGNE prétendait qu'au cas où les espaces angulaires eussent été au début remplis, ils devaient néanmoins s'être vidés, dans le système même de PRIVAT DE MOLIÈRES, par l'action de la pesanteur, expliquée par les efforts centrifuges des petits tourbillons. « Afin, répondait-il, qu'un corps dont les parties sont sans mouvement reçoive l'action de la force centrifuge des petits tourbillons, il faut qu'il soit plus grand que ces tourbillons, et que par là il donne prise à leur action. Or ici c'est tout le contraire, cette matière anguleuse doit évidemment être beaucoup plus petite que les tourbillons, puisqu'elle est contenue dans l'angle qu'ils font; de plus cette matière est évidemment située hors de la portée de l'action commune des petits tourbillons, qui est la cause efficiente de la pesanteur; et à cet égard on la peut considérer comme contenue parmi des tourbillons qui ne circulent pas autour d'un centre commun, et il faut bien considérer que l'action par laquelle ces petits tourbillons compriment cette matière n'est pas celle par laquelle ils poussent au centre un corps beaucoup plus grand qu'eux. Enfin tous les efforts d'un tourbillon sont contrebalancés par ceux des autres. Il est donc de la dernière évidence que cette matière ne peut tendre à sortir de l'espace angulaire et à s'acheminer vers le centre du tourbillon » (42).

(41) *Op. cit.*, p. 11.
(42) *Op. cit.*, p. 15-16.

L'objection tirée par SIGORGNE de la nécessité pour les tourbillons de faire leurs révolutions dans des circonférences rigoureuses ne paraissait pas plus solide à LE CORGNE DE LAUNAY. Elle ne lui semblait pas de nature à ruiner un système dans lequel tout reposait sur « des petits tourbillons contenus dans un tourbillon composé, qui sont tous en équilibre les uns avec les autres, et qui font leurs révolutions tant autour d'un centre commun qu'autour de leurs centres particuliers, et non pas des globules durs tels que le concevait DESCARTES » (43). Dès lors, prétendre « que les petits tourbillons, semblables aux globules durs de DESCARTES, ne peuvent changer de figure à la rencontre de quelque obstacle, qu'il soit nécessaire qu'ils s'arrêtent là, et qu'ils perdent leur mouvement » était une supposition purement gratuite, contraire aux principes du système auquel on s'efforçait de l'opposer. D'ailleurs, serait-il vrai que les petits tourbillons fussent astreints à se mouvoir suivant des circonférences rigoureuses, que cela ne ruinerait pas le système; car il resterait à prouver que de telles circonférences seraient impossibles. » L'on ne voit dans la matière et dans l'idée de l'étendue aucune incompatibilité avec cette figure; au contraire, je conçois aisément que la figure n'étant que l'étendue, en tant que terminée de telle ou telle façon, l'étendue peut aussi bien être terminée en globe parfait qu'en globe imparfait, ou en toute autre figure » (44).

Bien plus « il n'est aucunement prouvé que le tourbillon composé ne puisse subsister que dans la seule hypothèse que le monde est infini ». (45) Les explications de SIGORGNE sur ce point paraissaient à LE CORGNE DE LAUNAY un tissu d'erreurs.

Enfin « il n'est point prouvé que, si un tourbillon contenu dans un espace solide rempli de tourbillons a plus de force centrale que ceux qui l'environnent, il doive s'étendre continuellement

(43) *Op. cit.*, p. 19.

(44) *Op. cit.*, p. 22. LE CORGNE DE LAUNAY rappelait en effet : « Je conçois que Dieu peut, s'il le veut, exécuter ce dont j'ai une idée claire, puisqu'il est incontestable que je n'ai point une idée de l'impossible; or il faut bien que j'aie une idée du cercle parfait, puisque j'en démontre clairement et distinctement toutes les propriétés, et que je ne le ferais pas, si réellement je n'en concevais pas la nature. L'on peut même assurer que l'on ne connaît les imperfections et les défauts du cercle imparfait que par l'idée du cercle parfait qui en serait exempt » (*Op. cit.*, p. 21-22).

(45) *Op. cit.*, p. 24.

aux dépens de ceux qui l'environnent, et qu'il n'y ait pas moyen que l'équilibre survienne entre ces tourbillons » (46). De même « il n'est point prouvé que, dans l'agrandissement d'un tourbillon, la quantité de mouvement contenue, tant dans ce tourbillon que dans ceux qui l'environnent, doive diminuer considérablement » (47). Le Corgne de Launay établissait encore que « dans un tourbillon composé de petits tourbillons, la vitesse des points de chaque superficie d'un tourbillon peut bien être égale à la vitesse de son centre dans la circonférence qu'il décrit autour du centre du grand tourbillon ». L'équilibre ne se trouvait pas non plus, à son avis, compromis par d'autres causes; car « on n'a du tout point prouvé que, dans un tourbillon composé, si la vitesse avec laquelle les petits tourbillons supérieurs circulent autour de leurs propres centres est plus grande par rapport à celle des inférieurs qu'elle ne doit l'être, la vitesse des supérieurs ayant passé de la superficie au centre, elle ne puisse pas passer du centre dans les couches du grand tourbillon jusqu'à la superficie, et qu'il n'y ait pas moyen que l'équilibre survienne » (48). De même encore que « il n'est point prouvé que, dans le tourbillon composé, la vitesse de ses points ne puisse pas également passer de la superficie au centre, comme du centre à la superficie, et qu'elle ne puisse pas passer du grand tourbillon dans les petits, comme des petits dans le grand » (49). Enfin « il n'est du tout point prouvé que, dans un tourbillon sphérique, composé si souvent de petits tourbillons, les frottements doivent beaucoup retarder les mouvements circulaires de ses points autour de son centre, et le tourbillon pourra perpétuellement subsister dans le même état » (50).

« Vous prétendez, répliquait encore Le Corgne de Launay à Sigorgne, que c'est une conséquence nécessaire des principes du système des *Leçons de Physique* qu'un tourbillon ne puisse subsister s'il n'est composé d'une infinité de tourbillons plus petits... Il est vrai que, dans les *Mém. de l'Acad.* 1729, et dans les *Leçons de Physique*, M. de M. a poussé, aussi loin que l'exige

(46) *Op. cit.*, p. 129.
(47) *Op. cit.*, p. 134.
(48) *Op. cit.*, p. 154.
(49) *Op. cit.*, p. 164.
(50) *Op. cit.*, p. 170.

l'explication des phénomènes, cette division et subdivision des petits tourbillons... Mais cependant j'ai entendu dire plusieurs fois à l'auteur des *Leçons de physique* que son dessein n'était pas de pousser cette subdivision à l'infini, parce que, les phénomènes pouvant être heureusement expliqués, sans cette subdivision, il est clair qu'on ne la doit point admettre. M. GAMACHES a été le maître de prendre, sur ce point, le parti qu'il lui a plu, et j'avoue franchement que, s'il me fallait opter ou de l'abandon des petits tourbillons ou de porter à l'infini leur subdivision, je prendrais le second parti, ou je renoncerais à la physique, dans l'étude de laquelle il ne me paraît pas qu'on puisse avancer sans le secours des petits tourbillons. Mais on n'en est pas réduit là, et vos raisons ne prouvent pas qu'on soit obligé d'admettre cette subdivision » (51).

En effet « les frottements n'empêcheront point ni ne détruiront point les mouvements circulaires : 1° parce que, pour déterminer les frottements, il faut avoir égard aux tourbillons d'un certain ordre et d'une certaine grandeur, et rien n'empêche de pousser fort loin la subdivision des petits tourbillons; 2° parce que, pour que les frottements ne détruisent pas une partie sensible des mouvements circulaires, il est évident qu'il suffit que ces tourbillons d'un certain ordre et d'une certaine grandeur soient élastiques, et fort élastiques; or l'on peut concevoir ces tourbillons doués d'une grande élasticité, sans qu'il soit nécessaire de les composer d'une infinité d'autres plus petits tourbillons » (52). Quant à l'équilibre d'un tourbillon composé, il ne paraissait pas exiger non plus l'infinité des tourbillons.

SIGORGNE jugea non seulement opportun mais nécessaire de poursuivre la discussion : la question lui paraissait trop importante pour être ainsi abandonnée avant d'avoir été résolue de façon décisive. Aussi fit-il paraître encore, en 1741, une *Réplique à M. de Molières*, qui portait en sous-titre *Démonstration physico-mathématique de l'impossibilité et de l'insuffisance des tourbillons.* Insuffisance fondamentale opposée à l'efficacité apparente, à laquelle faisait allusion SIGORGNE avec quelque ironie : « Il n'y a point d'effet dans la nature, écrivait-il, pour surprenant et extra-

(51) *Op. cit.*, p. 333.
(52) *Op. cit.*, p. 334.

ordinaire qu'il soit, que je ne puisse expliquer sur-le-champ à l'aide d'un petit tourbillon combiné de telle ou telle façon. Qu'on me propose un fait faux, je l'expliquerai avec plus de facilité encore que s'il était réel. Une expérience m'embarrasse-t-elle, je fais un tour de bâton, et la difficulté disparaît; et cette expérience fût-elle une démonstration contre moi, j'aurai assez de ressources pour faire voir au contraire, à ceux qui ne réfléchissent que médiocrement, qu'elle fait entièrement pour mon système. Donnez-moi des petits tourbillons, et j'explique tout, vrai ou faux, cela m'est égal. Heureuse fécondité, ou plutôt démonstration sensible de la fausseté de ce système » (53).

Sur l'impossibilité de l'équilibre d'un tourbillon composé de petits tourbillons, SIGORGNE insistait de nouveau, en montrant l'inégalité des sommes des forces centrales correspondant aux petits tourbillons de deux couches différentes d'un grand tourbillon, d'après les principes mêmes de PRIVAT DE MOLIÈRES. Supposer en effet l'égalité en force chacun à chacun des petits tourbillons composant les différentes couches, serait donner à la grande couche l'avantage sur la petite, puisqu'elle aurait plus de petits tourbillons. Et l'on ne ferait qu'augmenter la difficulté en faisant plus petits les tourbillons de la grande couche. En les supposant plus grands par contre, il faudrait admettre que leurs nombres soient en raison réciproque de leurs forces, et plus exactement, pour éviter certaines difficultés attachées aux principes de PRIVAT DE MOLIÈRES, qu'à un petit tourbillon de la couche inférieure corresponde, dans la couche supérieure, deux petits tourbillons lui opposant ensemble une force égale. Mais « pour qu'un tourbillon, ripostait SIGORGNE, en dépouille un autre, il suffit qu'il ait plus de force que lui au point de contact. Or, quoique les forces de deux tourbillons supérieurs ajoutées en une somme soient égales à la force d'un tourbillon inférieur, cependant, comme celui-ci les touche par deux points différents, il est clair qu'il aura à chaque point de contact plus de force que chacun d'eux » (54).

S'appuyant d'autre part sur une démonstration du P. CASTEL (55),

(53) *Op. cit.*, avis, p. 5.

(54) *Op. cit.*, p. 33.

(55) *Mémoires de Trévoux*, juillet et septembre 1739. Au mois d'août, fut insérée une réponse de PRIVAT DE MOLIÈRES au P. CASTEL.

SIGORGNE posait que « les petits tourbillons, s'il y en avait, ne seraient pas longtemps sans se confondre ». Et il faisait remarquer qu'en fait les fluides homogènes (et ce serait le cas de la matière composant les petits tourbillons) se confondent quand ils se trouvent en contact. « Pour nous former une image encore plus sensible de cette vérité, proposait SIGORGNE (56), représentons-nous un grand bassin sphérique plein d'eau, dans lequel nous ayons excité tout d'un coup avec plusieurs bâtons un grand nombre de petits tourbillons d'eau : l'expérience apprend que ces tourbillons se mêlent, se confondent et se dissipent bientôt. Or pourquoi n'en arriverait-il pas de même aux tourbillons qui seraient excités dans la matière éthérée ? »

Tout naturellement la question des espaces angulaires reparaîssait ici. Sur la première partie de la réponse faite par LE CORGNE DE LAUNAY, SIGORGNE répliquait qu'il ne suffisait pas de poser le plein antérieur aux petits tourbillons. Car « la question est de savoir si, aussitôt que les tourbillons ont existé, ils n'ont point dû faire circuler autour de leurs centres cette matière anguleuse. Vous ne vous en mettez point en peine dans votre réponse; mais cela n'en doit pas moins être dans vos principes. Cette matière est, dans ce premier instant, déliée, uniforme, en repos; elle a donc toutes les conditions que vous demandez pour qu'elle soit déterminée à circuler autour des centres des tourbillons qui la touchent. Il est de plus question de savoir si, aussitôt que les petits tourbillons diminueront en volume, et que par conséquent les espaces qui sont entre eux se rétréciront, la matière qui les remplissait n'en sera pas subitement chassée par le mouvement circulaire des molécules qui composent les petits tourbillons; c'est encore de quoi vous ne parlez point; quoiqu'il soit manifeste qu'un corps ne peut rester dans un espace plus petit que lui » (57).

La seconde partie de la réponse proposée par LE CORGNE DE LAUNAY, pour expliquer que la matière angulaire ne devient pas pesante par l'action des petits tourbillons, ne paraissait pas plus solide à SIGORGNE. « Ainsi donc, répliquait-il, prenant le contrepied de DESCARTES, qui disait qu'un petit corps ne peut

(56) *Op. cit.*, p. 37.
(57) *Op. cit.*, p. 41-42.

agir sur un grand, vous soutenez que c'est le grand qui ne peut mouvoir le petit. Nouveau et étrange paradoxe ! » (58).

Revenant sur l'impossibilité des petits tourbillons tirée par lui de la nécessité où ils se trouveraient de faire leurs révolutions dans des circonférences rigoureuses, par définition irréalisables, SIGORGNE se contentait de renvoyer, pour l'impossibilité de réalisation du cercle parfait, à VARIGNON et à TACQUET. En réponse d'autre part à LE CORGNE DE LAUNAY assurant que les petits tourbillons peuvent changer de figure à la rencontre d'un obstacle, il remarquait : « En vérité ce sont de vrais protées que vos tourbillons. Faut-il produire la dureté du diamant, etc. ils sont d'une raideur extrême et sans égale; ce sont autant de petits corps durs. Et en d'autres cas, suivant le caprice des hommes, ils sont plus que fragiles. Vous auriez dû commencer par éviter ce défaut qu'on a tant reproché au P. MALEBRANCHE » (59).

Enfin soutenir qu'en dehors du monde il n'y a point de vide paraissait encore à SIGORGNE un autre paradoxe.

4. — LA FIN DU DÉBAT. CONCLUSION

La mort de PRIVAT DE MOLIÈRES (12 mai 1742) laissa LE CORGNE DE LAUNAY seul aux prises avec SIGORGNE. Jugea-t-il inutile la continuation d'une polémique qui menaçait fort de rester stérile, ne se soucia-t-il pas de tenir tête plus longtemps à SIGORGNE, en qui il sentait un adversaire redoutable, ou bien considéra-t-il vraiment comme une œuvre plus utile la rédaction d'un résumé des *Leçons de Physique*, augmenté d'un mémoire inédit de PRIVAT DE MOLIÈRES ? Quoi qu'il en soit, dans la préface de ses *Principes du système des petits tourbillons mis à la portée de tout le monde*, publiés en 1743, LE CORGNE DE LAUNAY manifesta son intention de s'abstenir désormais de toute discussion. « Je me suis déterminé,

(58) *Op. cit.*, p. 42. « Mais, quand on vous accorderait ce principe, continuait-il, qu'en concluriez-vous ? Que cette matière angulaire ne sera pas précipitée au centre du grand tourbillon ? A la bonne heure, vous dira-t-on ; mais rien n'empêche qu'elle ne soit portée aux centres mêmes des petits tourbillons qui la touchent. Car pour cette fois vous ne direz pas que les molécules qui composent ces petits tourbillons sont plus petites que les espaces que ces tourbillons forment entre eux ».

(59) *Op. cit.*, p. 43-44.

dit-il, à proposer encore une fois au public les petits tourbillons, armés de toute la force que j'ai pû leur prêter; et je puis assurer qu'il n'y aura pas de ma faute, s'il ne les agrée pas. Mais aussi je ne pousserai pas leur défense plus loin, et je déclare par avance que je ne suis point dans l'intention de répondre à ceux qui voudraient encore les attaquer. Si cet ouvrage engage quelques physiciens à embrasser l'hypothèse des petits tourbillons, à la bonne heure; si au contraire plusieurs autres s'imaginent y trouver des difficultés insurmontables, je leur saurais mauvais gré de ne pas s'attacher à un système différent » (60).

Il ne crut pas cependant possible de passer tout-à-fait sous silence la polémique précédente et de ne pas résoudre au moins les objections essentielles élevées contre les petits tourbillons. C'est ainsi qu'un de ses théorèmes établit que « il n'est point nécessaire de multiplier les tourbillons à l'infini » (61), et un autre que « les parties des tourbillons ne doivent pas s'échapper par les espaces angulaires qu'ils laissent entre eux ». Dans la démonstration, d'ailleurs très courte, il se contentait de résumer l'essentiel des arguments antérieurs, en les présentant toutefois sous une forme qui pouvait, jusqu'à un certain point, paraître une réponse aux dernières difficultés soulevées par SIGORGNE. En effet, après avoir rappelé que les espaces angulaires étaient remplis de matière, il continuait : « Les tourbillons ne doivent point chasser cette matière de l'espace angulaire. Car, s'ils devaient chasser cette matière de l'espace angulaire, ce serait, ou en la faisant circuler autour de leur centre, ou en l'y précipitant par la pesanteur. Or ni l'un ni l'autre ne doit arriver. 1° Les tourbillons ne peuvent faire circuler cette matière autour de leurs centres. Car tous les efforts que fait un tourbillon pour pénétrer dans l'intérieur de l'angle étant parfaitement égaux à ceux que font les autres tourbillons pour y pénétrer pareillement, il est impossible qu'aucun d'eux détermine cette matière à circuler autour de son centre, ne pouvant pas même pénétrer dans l'angle; mais tous leurs efforts se termineront à la comprimer avec force, et à la rendre par là très dure, tandis qu'elle sera engagée dans cet espace. 2° Ils ne peuvent non plus la rendre pesante; car, pour qu'elle

(60) *Op. cit.*, p. x.
(61) *Op. cit.*, p. 141.

devienne pesante, il ne suffit pas qu'elle ne soit pas mue en tourbillon, mais il faut de plus qu'elle soit renfermée dans l'intérieur de quelque tourbillon. Or cette matière n'est pas renfermée dans l'intérieur des tourbillons, au contraire elle est manifestement hors de la sphère de leur action. Donc les tourbillons ne peuvent aucunement s'échapper par les espaces angulaires qu'ils laissent entre eux » (62).

Ainsi donc, sans que les questions soulevées aient été complètement résolues dans un sens ou dans l'autre, la position des disciples de MALEBRANCHE se trouvait dès lors singulièrement ébranlée, et la doctrine des petits tourbillons apparaissait de plus en plus compromise dans sa solidité. D'ailleurs, à mesure que la doctrine cartésienne perdait du terrain, la question de savoir si, outre les grands tourbillons, il y en avait encore de petits, voyait son intérêt faiblir; or, dès cette époque, le triomphe du newtonianisme ne pouvait plus guère faire de doute, si l'on tient compte de la force respective des adversaires en présence. Aussi pouvons-nous arrêter là l'exposé de cette polémique, dont les suites n'apparaissent plus que comme des épisodes sans importance après cette période décisive, d'où la physique de MALEBRANCHE, irrémédiablement liée à celle de DESCARTES, sortait amoindrie et vouée à l'échec.

Joigny, Yonne. PIERRE BRUNET.

(62) *Op. cit.*, p. 143-144.

Lavoisier's early work in science 1763-1771

II *

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PART III **

Introduction

My chief purpose, in the remaining part of this paper, is to study LAVOISIER's work upon the Nature of Water in itself and in its bearing on opinion in the eighteenth century : to show how it arose, how it was carried on, how it was published and how it was received.

There is need for a fuller examination of this work than has yet been attempted. It has never been treated adequately by the historians of chemistry : most of them have treated it in a negligent manner. BERTHELOT came to conclusions that are remarkable. Disparaging LAVOISIER's work, he described it as " still the work of a beginner " *(c'est encore l'œuvre d'un débutant)*. All that LAVOISIER did, according to him, was " to take up a

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* See *Isis*, 19, 330-63.

** A note, on the subject of Part III, was read at the History of Science Congress, London, 1931 (*Archeion*, 14, 246, 1932).

problem that had already been solved by BOERHAAVE " and on which " certain doubts remained " and to " attack it by a sharper and more reliable method " (*Berthelot*, pp.45-6).

My main findings are that LAVOISIER, in continuation of his work on Hydrometry, began to study the Nature of Water under a stimulus that came from LEROY, that the essential thing in his work was the preparation of water as a pure substance and, arising out of this, that he took up and solved a question, namely, if water is transmuted into earth, that eminent men, including BOYLE, BOERHAAVE and MARGGRAF, had studied in vain.

(i) LEROY on the Nature of Water

DÉPARCIEUX's memoir of the year 1766 had an effect upon LAVOISIER in two ways. Directly it led him, as has been shown, to take up work upon Hydrometry. Indirectly, through LEROY, it led him to take up work upon the Nature of Water.

DÉPARCIEUX's memoir was read at the *Académie des Sciences* at a *rentrée publique* and again, by instalments, in order to give members the opportunity of considering it in detail. A noteworthy comment was made upon the method of examining a water by evaporating it to dryness. There was involved with this method, it was remarked, the question if water is transmuted into earth. My impression is that this question was raised in a spirit of agnosticism : that at the *Académie des Sciences* nobody was convinced either that water is transmuted into earth or that the supposed transmutation had been disproved.

LEROY (15), who was a physicist, pursued this question further and read a memoir on it at the *rentrée publique de Pâques*, 1767. We know of that memoir mainly through the notice that DEFOUCHY (16) took of it in the *Histoire de l'Académie des Sciences*.

DEFOUCHY's notice is valuable because it indicates the state of contemporary opinion on the question at issue. The introductory paragraph reports the position of the doctrine that there are four elements : although this doctrine was widely accepted

(15) JEAN BAPTISTE LEROY (1719-1800) : his brother, PIERRE LEROY, made chronometers of surpassing quality.

(16) JEAN PAUL GRANDJEAN DEFOUCHY (1707-1788).

there were persons who maintained that water is transmuted into earth : if that were true a doctrine of long standing must be abandoned; moreover, chemical analysis must be vitiated.

" In ancient times four elements were recognised, that is to say, four primitive and stable materials which entered more or less into the composition of all substances; these primitive materials were air, water, earth and fire : this idea has been adopted by nearly all physicists. We say nearly all because there certainly can be found some moderns who have rejected it and maintained that these substances, that were taken to be primitive and unalterable elements, were themselves composed of other substances and could change their form. Their aim, above all, is to show that the water which we have at hand, so to say, more than any other elementary substance, could be converted into earth and consequently is neither simple nor stable. One can readily see that this assertion, if it were true, would upset all accepted ideas and would destroy, beyond recovery, all the certainty that one can expect of chemical analysis, because one could never be sure that the substances obtained by the decomposition of a mixture, instead of being the materials that were in it, were not the results of the process."

" Those, however, who have impugned the unalterability of water, if one may make use of this term, have not done so without the support of some weighty reasons " (*H.A.R.S.*, 1767, 14).

DEFOUCHY next shows how LEROY's memoir arose :

" This point [the transmutation of water into earth] having been discussed in the Academy on the occasion of the project that Mr. DÉPARCIEUX formed for bringing to Paris the water of the Yvette Mr. LE ROY believed that it deserved the most careful consideration and this, all the more, because of the extreme importance of knowing what opinion to hold on a view that tends to overthrow the idea, which is so ancient, that water is unalterable " (*ibid.*).

LEROY, on consideration of the evidence in favour of the belief that water is transmuted into earth, showed by " reasons and proofs... that one cannot decide against the feeling of those who regard water as unalterable." He disposed of the evidence in a way that was all his own : the evidence indicated to him that earth is essential to the nature of water; that, on distillation of water, water and earth pass over together and, at the same time, that a small part of the earth is left behind. This residue, imposing on men of science, made them believe that water is transmuted into earth.

LEROY denied that, by distillation, water can be obtained free from earth; those who think it can—I am again quoting DEFOUCHY—those who think it can

" suppose that, after a certain number of distillations, all the earth that might be associated with the water, may be separated from it; but nothing is more

gratuitous than this supposition; it is supremely difficult to obtain single substances and chemists continually meet with this difficulty : we have shown, moreover, that some parts of earth and even of glass may be fine enough to be carried off with the molecules of water to which they are adherent and that consequently it is impossible that distillation should completely separate one from the other " (*loc.cit.*, 21-2).

(ii) LAVOISIER's work on the Nature of Water : its origin

LAVOISIER, in his work on Hydrometry, had accepted LEROY's teaching. In his second memoir on Hydrometry, as I have said, he condemned the method of examining a water by evaporation to dryness. He appealed to

" Mr. LE ROY, of this Academy, who, guided by the light of true science... has maintained by well founded arguments, that a considerable amount of earth could pass over with water during distillation."

LAVOISIER believed that true salts, even more readily than earth, would volatilise with water (*O.L.*, 3, pp.148-9).

The basis of LAVOISIER's work needed consideration. He had engaged in Hydrometry, for more than a year, under the conviction that the specific gravity of a water must be affected by anything dissolved in it. He had ascertained the density of distilled water and, by reference to it, proposed to ascertain the density of other liquids. But he had not given enough attention to LEROY's teaching in its bearing on all this work. Water, according to LEROY, contained earth of which a part was left behind on distillation. Consequently, the amount of earth in water was variable : was greater before than after the water was distilled. Hence the value of water as a standard substance was doubtful. LAVOISIER must needs ascertain the effect upon water of distilling it again and again.

(iii) LAVOISIER's experiments

Early in August, 1768, LAVOISIER made ready for his experiments by collecting about 12 *livres* of rain-water. Whilst he had a new purpose in view he proceeded to work on old lines. He compared the rain-water with a standard—it was water, from the Seine, once distilled—by means of the copper hydrometer that he had used in finding the apparent weight of water at different temperatures.

Its weight, 4 *livres* 7 *onces* 8 *gros* 56.50 *grains*—as found in January—appears in the memoir on the Nature of Water (*O.L.*, 2, pp.13,23).

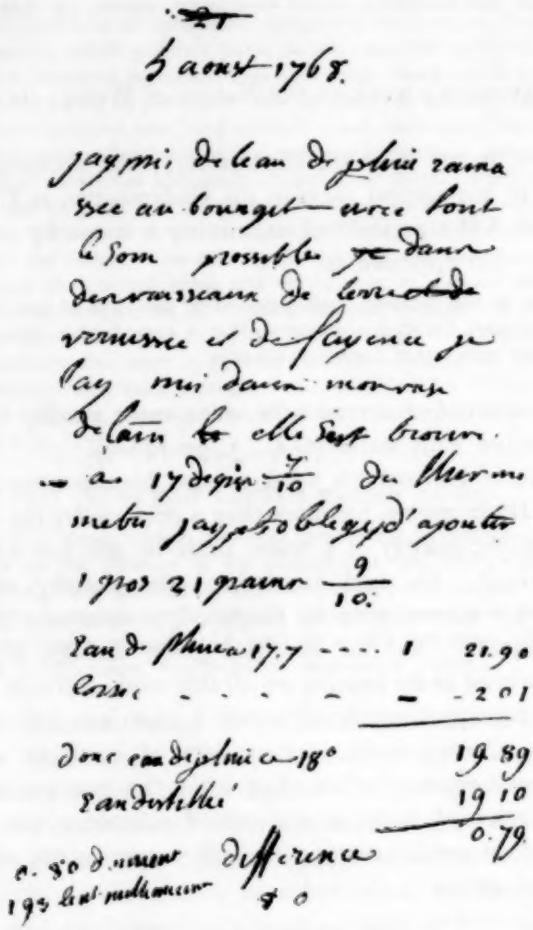

FIG. II

The commencement of work upon the Nature of Water : 5th August, 1768

(1) The rain-water

(LAVOISIER, *Expériences et analyses de diverses eaux 1768*, p.30v, Archives de l'Académie des Sciences)

LAVOISIER made notes in the book, already mentioned, which is labelled *Expériences et analyses de diverses eaux 1768* (see FIGS. II and III).

" 5 aoust 1768.

" jay mis de leau de pluie ramassee au bourget avec tout le soin possible dans des vaisseaux de terre vernissee et de fayence je lay mis dans mon vase detain elle sest trouvee a 17 degres 7/10 du thermometre jay ete oblige d'ajouter 1 gros 21 grains 9/10 " (p.30v.).

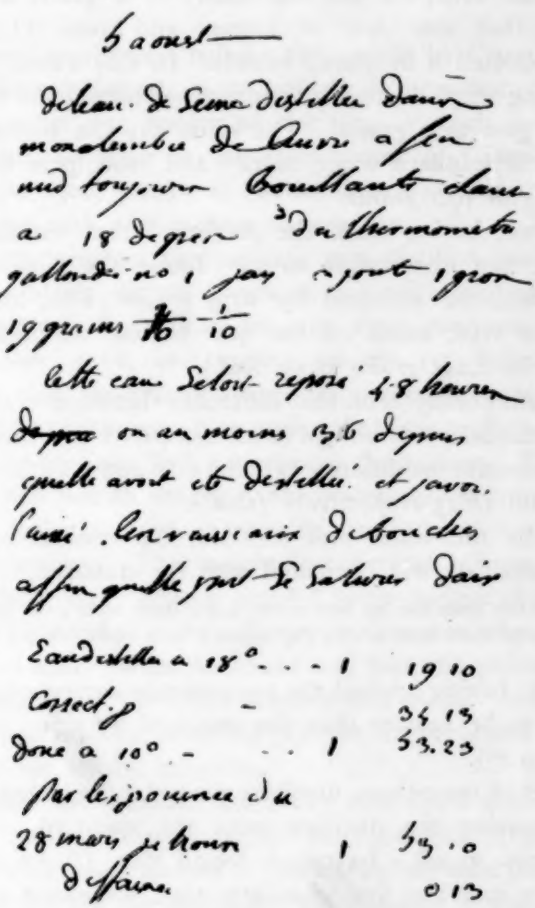
5 aoust
Deleau de Seine distillee dans
mon alembic de cuivre a feu
nud toujours bouillante dans
a 18 degres du thermometre
gallonde no 1 jay ajoute 1 gros
19 grains 7/10 1/10
Cette eau Selon reposé 48 heures
depose en au moins 36 heures
quelle avoit été distillé. et javoi.
Lavé. les vaisseaux de bouches
assez quelle peut se saturer dair
Eau distillé a 18°. . . 1 19 10
Correct. p - 34 13
donc a 10° - . . 1 53.23
par les journaux du
28 mars je trouve 1 54.0
de pouce. 013

FIG. III

The commencement of work upon the Nature of Water : 5th August, 1768

(II) The standard water

(LAVOISIER, *Expériences et analyses de diverses eaux 1768*, p.32r. Archives de l'Académie des Sciences)

" 5 aoust

" de leau de Seine distillee dans mon alembic de cuivre a feu nud toujours bouillante donc a 18 degres du thermometre gallonde no 1 (17) jay ajoute 1 gros 19 grains 1/10.

" Cette eau setoit repose 48 heures ou au moins 36 depuis quelle avoit ete distillee et j'avois laisse les vaisseaux debouches affin quelle put se saturer dair " (p.32r.).

LAVOISIER went, for the rain-water, to a place, at Le Bourget (17a), that was clear of houses and trees (*O.L.*, 2, p.12) and he collected it in glazed vessels. In this water, the temperature being 17.7° R., the hydrometer was brought to the mark by adding 1 *gros* 21.0 *grains*. The same day the hydrometer was put into the standard water, at 18°, and brought to the mark by adding 1 *gros* 19.1 *grains*.

LAVOISIER, having made the correction that was necessary to bring the first observation to 18°, found the rain-water to be heavier than the standard by 0.79 *grains* (0.80, *op.cit.*, p.13). In another trial, made on the 9th August, the difference was found to be 1.245 *grains* (1.25, *ibid.*).

It is noteworthy that the difference between the rain-water and the standard was always small compared with the correction for temperature: the differences being 0.80 and 1.25, the corrections were 2 and 10.45 respectively *(ibid.)*.

Next the rain-water was distilled, the residue was weighed and the distillate was compared with the standard.

" jay distillee cette eau au bain marie a feu doux au feu de lampe et yayant mis laerometre ther. donc a 16.4 j'ay ajoute 1 gros 29.80" (p.31r.).

LAVOISIER, having applied the temperature correction, found this distillate to be heavier than the standard by 0.799 *grains* (0.80, *O.L.*, 2, p.27).

This set of operations, distilling the water, weighing the residue and comparing the distillate with the standard, was repeated eight times in all. LAVOISIER found that (1) in density, the rain-water and the first distillate were somewhat greater than the standard, that the second distillate was the same as it and that the subsequent distillates were slightly less; (2) the residue in the first and in the second distillate was large and, subsequently, was always small.

(17) A thermometer (Réaumur's scale), made by GALLONDE, which LAVOISIER used as a standard (*O.L.*, 3, pp.451-2; 458).

(17a) At Le Bourget, which was then in the country, Mademoiselle PUNCTIS, LAVOISIER'S aunt, was the owner of a house and garden : his father died in that house (*Berthelot*, p.26; *Grimaux*, pp.40,41).

LAVOISIER proceeded to examine the effect of water upon glass. He used a glass vessel which, from its shape, was called a pelican : it was so designed that, when water was heated in it, the vapour would condense at the top and the resulting liquid run back.

LAVOISIER employed a balance (18), made by CHEMIN, *ajusteur de la Monnaie* (*op.cit.*, p.17), which " surpassed in accuracy everything that was known at the time in such instruments " (LADENBURG, *Lectures on the Development of Chemistry*, trans. by DOBBIN, 1900, p.22) : it would turn with less than 1 *grain* when loaded with 5 or 6 *livres* in each pan.

LAVOISIER weighed the pelican, put distilled water into it, sealed it—taking certain precautions—and weighed it again. He next heated the pelican for 100 days commencing on the 24th October, 1768, and ending on the 1st February, 1769. He found that the system — pelican and water — had changed in weight by an amount, 0.25 *grains*, that was negligible. Hence BOYLE's fire-particles had not entered the system. The pelican, by itself, had lost in weight. The water, which contained solid particles, had increased in specific gravity; on evaporation it yielded a residue. The weight lost by the pelican, according to BERTHELOT, was " exactly equal " to the weight of solids from the water (*Berthelot*, p.46). Certainly that was what LAVOISIER expected to find. What he found was that the pelican had lost 17.4 *grains* and that the solids weighed 20.4 *grains*. On examining this solid material he observed (1) that it effervesced with acid; (2) that it was almost infusible.

LAVOISIER was satisfied that water acts upon glass. On that basis he could interpret certain discrepancies in his results : (i) the distilled water seemed to become lighter than the standard : he judged that the distilled water was constant in specific gravity and that the standard had increased because it dissolved the glass of the bottle in which it was stored; (ii) the pelican had lost less than was found in the water that had been heated in it : he judged that the water, after it was emptied out of the pelican,

(18) The evidence is that LAVOISIER used this balance so early as January, 1768, whilst it was in the possession of CHEMIN (this paper, 19, 360-63; *O.L.*, 3, p.451) and later purchased it for the purpose of this work on the nature of water.

gained material from the glass vessels in which it was put and, also, that on evaporation a small amount of water might have been left in the residue (*O.L.*, 2, p.25).

Discrepancy no. ii, which LAVOISIER explained away, was due to a cause that he could not detect. The glass, of which the pelican was made, contained alkali—soda or potash—and lime which, dissolved in water, absorbed carbon dioxide during the evaporation to dryness. This absorption of carbon dioxide —I am indebted to Dr. LEONARD DOBBIN for drawing my attention to it—was an inevitable cause of increase in weight. I am satisfied that it was the predominant cause (19).

LAVOISIER's main conclusions can be summarised thus: (1) water distilled slowly once or twice in a metal alembic is absolutely pure; (2) glass resembles a salt by dissolving in water up to a limit; (3) water is unchangeable; the earth, that was thought to come from water, came from the vessels in which the water was put (*op.cit.*,pp.25-6).

LAVOISIER was better satisfied with his conclusions than with the experiments on which they were based. He had met with discrepancies and had explained some of them in terms of what he had proved once for all, namely, that water dissolves glass. One discrepancy he could not explain—he had obtained from the water, in the experiment with the pelican, a residue that, unlike glass, was almost infusible. That was awkward because and so long as he held that glass could dissolve in water like a salt. This discrepancy troubled him. He drew attention to it, in his final memoir on the Nature of Water, and announced that he would repeat the experiment with the pelican. He had recommenced that experiment also in the year 1771 (*Berthelot*, p. 221). But these repetitions came to nothing.

The historians of chemistry, in treating of this subject, have let the experiment with the pelican engross their attention. KOPP even said, in error, that LAVOISIER, unlike previous workers, proceeded to make that experiment without troubling to distil water again and again (*Kopp*, 3, p.257).

(19) The pelican lost 17.4 *grains*; the residue from the water was 20.4 *grains*: gain, 3 *grains* or 17.2 per cent. Soda glass—composition, Na_2O, CaO, $6SiO_2$—by absorption of carbon dioxide, would gain 18.3 per cent.; potash glass, of corresponding composition, would gain 17.2 per cent.

"It is supremely difficult to obtain single substances," LEROY said, "and chemists continually meet with this difficulty." The difficulty is always with us. The preparation of pure substances is of the first importance in chemistry and also in physics. A substance is said to be pure when it meets certain requirements or specifications. Purity is tested by the determination of physical constants and by chemical analysis, both of which, in turn, depend upon pure substances.

At the time when LAVOISIER was at work upon the Nature of Water a pure gas had hardly been thought of. Not many liquids and solids, of high quality, can have been obtained if only because chemical analysis was in a backward state. Certain substances, no doubt, were obtained in good condition as a result of practice based upon tradition, e.g. gold, silver, corrosive sublimate, calomel.

LAVOISIER, the historians of chemistry agree, gave the correct explanation of the supposed transformation of water into earth. But the refutation of an error is a minor triumph. He went further than these historians knew. He laid down a technique for purifying water and for testing it, his aim being the use of water as a standard substance.

(iv) LAVOISIER's memoir : the delayed reading

LAVOISIER pursued his experiments on the Nature of Water from August, 1768, to March, 1769. He prepared a memoir on the subject that was *paraphé* by DEFOUCHY on the 10th May, 1769. Then came a delay of a year and a half. LAVOISIER read his memoir, modified for the purpose, at the *Académie des Sciences*, at the *rentrée publique* of Martinmas held on the 14th November, 1770.

This delay is puzzling. It might be supposed that LAVOISIER's duty, as an official of the *fermes*, kept him away from Paris and from attending the *rentrée publique* of Martinmas, 1769, and of Easter, 1770. But I have no confidence in that supposition. LAVOISIER was an important enough official to have the power of so arranging his programme as to be in Paris at Martinmas and Easter if he so desired.

A better explanation is to be found on all or some of the

following grounds: (1) LAVOISIER, in his 26th year, professed to have solved a problem which, for a hundred years, had baffled men whose reputation in science was great; (2) recently admitted to the *Académie des Sciences*, he was proposing an improvement on an Academician of 18 years' standing, namely, on LEROY; (3) LEROY's memoir on the subject had been read at a *rentrée publique* and LAVOISIER wanted the same distinction for his memoir; (4) his experiments, showing discrepancies between expectation and result, were open to comment and criticism and required consideration.

I find that LAVOISIER gave no prominence in his memoir to the fact that he was making an improvement on LEROY. He mentioned LEROY only as one who maintained that the transmutation of water into earth had not been proved. Also I find that his memoir, having been *paraphé*, was returned to him at once. He may have wished to have it read by his friends in science. DEFOUCHY's note on the memoir is as follows:

> " Le présent écrit contenant 30 pages m'a été presenté le 10 May 1769 pour estre paraphé ce que j'ay fait et l'ay rendu à l'Instant " [signé] " DEFOUCHY " (*Lavoisier MSS.*, no.1299).

LAVOISIER's memoir raised difficulties that DEFOUCHY had to meet. Ought LEROY's memoir to appear in the *Mémoires de l'Académie des Sciences?* DEFOUCHY had to write a notice of that memoir: what was he to say? Perhaps he wanted time in which to consider the two memoirs together and to form a mature judgment upon them. Perhaps he postponed consideration until the memoirs of the year 1767 must be prepared for publication. Be that as it may the facts are that LEROY's memoir was not published in the usual way, that publication was limited to the notice that DEFOUCHY took of it in the *Histoire de l'Académie des Sciences*—this notice seems to me unusually long—and that LAVOISIER's memoir was read in the year 1770, not at the more important *rentrée publique* of Easter, but at the less important *rentrée publique* of Martinmas.

(v) LAVOISIER's memoir: the different versions

LAVOISIER's memoir on the Nature of Water is found in different versions which are as follows:

I. *Sur la nature de l'eau et sur les expériences par lesquelles on a prétendu prouver la possibilité de son changement en terre* (*Lavoisier MSS.*, no. 1299, 2 MSS.).

II. *Dissertation. L'eau la plus pure contient-elle de la terre, et cette eau peut-elle être changée en terre?* (*I.O.P.*, 1771, 1, 77-88).

III. *Sur la nature de l'eau et sur les expériences par lesquelles on a prétendu prouver la possibilité de son changement en terre* (*M.A.R.S.*, 1770, *Premier Mémoire*, 73-82; *Second Mémoire*, 90-107; *O.L.*, 2, pp. 1-11; 11-28).

I. *The two* MSS. (*1769*)

The two MSS. show that LAVOISIER hoped to read his memoir at a *rentrée publique* of the *Académie des Sciences*. In each he disposed of the history of the subject in two paragraphs—giving as reason the fact that the time at a *rentrée* was limited—and stated his intention to treat it fully in a separate memoir. One of the MSS. is to be regarded as official because it was *paraphé* by DEFOUCHY; the other, which is marked " lu 14.9. (20) 1770 ", was prepared for reading at a *rentrée publique*; it gives a statement of results, instead of data such as the details of weighing and of specific gravity determination, and a set of conclusions, numbered, tersely put and arranged in logical sequence, instead of a discussion of results.

II. *The* Dissertation (*1771*)

An anonymous *Dissertation* was published in a manner that requires explanation. My reading of the matter is that LAVOISIER was eager to have work, that he knew to be important, made widely known at an early date. He had been doing scientific work since the year 1763 : only his first memoir on gypsum had appeared in print. The *Académie des Sciences* was always in arrears with its publications : the prospect was that this memoir on the Nature of Water, recounting work that he had completed in the year 1769, would be published in the year 1773. A scientific periodical, which ROZIER (21) was commencing,

(20) The 14th of November which is the 9th month by derivation.

(21) JEAN FRANCOIS ROZIER (1734-1793).

afforded an opportunity that LAVOISIER took. The ground was carefully prepared. In the first number of ROZIER's periodical there appeared a *Dissertation* in which FERNER (22) maintained a doctrine, which was current then, that the water of the seas is gradually diminishing. He believed that water is transmuted into earth. The paragraph in which he took that transmutation into consideration was accompanied by a footnote in which ROZIER drew attention to LAVOISIER's work. FERNER's *Dissertation* appeared, the first article in the first number, namely, that for July : the anonymous *Dissertation* appeared, the first article in the number for August.

This *Dissertation* gives an account of LAVOISIER's work that corresponds, approximately, with what was read at the *rentrée publique*. It is notable, otherwise, in various respects : the opening paragraphs are full of compliments to LAVOISIER; the account of his work is said to have been written from memory; the details of experiments are given.

The first paragraph touches on FERNER's *Dissertation*, names a series of workers on the transmutation of water into earth and finally brings in LAVOISIER :

> " It was reserved for Mr. LAVOISIER to throw a new light on a matter that is important in physics and chemistry..."
>
> " We should like to place before the eyes of the reader the excellent Dissertation of Mr. LAVOISIER where he treats this question in a surpassing manner; but as the Academy detains this valuable effort in order to publish it in its collections... we shall report to-day the principal facts that we have kept in mind. The clear and precise style of Mr. LAVOISIER, the natural way in which he presents his ideas, his great power in description, all concur to fix them firmly in the memory. To publish such discoveries quickly will gladden the chemist and the physicist in anticipation; and if what we are about to publish is inferior to Mr. LAVOISIER's Dissertation, the reader will excuse us because of our motive. We venture to hope, nevertheless, that what we shall say will be enough to make him abandon every probability, every hypothesis, every doctrine involving the presumed change of water into earth. The knowledge of one truth is the first step towards the discovery of another" (*I.O.P.*, 1771, 1, 79).

How was this Dissertation produced? The answer is that ROZIER and LAVOISIER had come to an understanding with one another. Saying that it was written from memory was a *façon de parler* that was meant to clear LAVOISIER from responsibility for it.

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(22) BENGT FERNER (1724-1802).

He must have been a party to its publication because he was a party to its composition. It goes into particulars and into minute details that could not have been produced from memory. It outlines the experimental procedure under 10 heads and gives 9 conclusions. For instance :

« Cinquième procédé. Le *pélican* de verre blanc, avec son bouchon de crystal, après avoir été lavé avec l'eau de pluie distillée, après avoir été nettoyé et séché avec la dernière exactitude, pesoit une livre dix onces sept gros et demi. Le poids de l'eau étoit de trois livres quatorze onces cinq gros et demi" (*loc.cit.*, 81).

The conclusions are the same in the memoir that was read at the *rentrée publique* and in the Dissertation : they have the same sequence. The only difference is that what are 5 conclusions in the first of these documents, by division, become 9 in the second.

III. *The* Premier Mémoire *and the* Second Mémoire (*1773*)

The *Mémoires de l'Académie des Sciences*, the volume for 1770 which was published in 1773, contains two memoirs on the Nature of Water, the *Premier Mémoire* and the *Second Mémoire*.

The indications are that LAVOISIER prepared these two memoirs for the press in the year 1773 and at a time when he was preoccupied with other work. They are separated from one another, in print, by a memoir on a different subject. Hence the *Premier Mémoire* was ready for the printer before, but not long before, the *Second Mémoire*.

The *Premier Mémoire*

LAVOISIER fulfilled, in the *Premier Mémoire*, his intention of giving a history of the subject. Moreover, he expressed in it opinions that he adopted in the year 1773. Whilst he held to orthodox doctrine regarding three of the elements—water, earth and fire—he uttered unorthodox, if not new, doctrine on air. He had to consider the evidence, on the transmutation of water into earth, that plants were supposed to afford. He referred to the opinions that came from botanists, from HALES in particular, that plants absorb materials from the air. He himself believed that the air is not an element.

" Although we do not yet possess a sufficiency of convincing experiments on the subject, nevertheless one cannot doubt that the lower layer of the atmosphere, that in which plants grow, is extremely complex. In the first place, it is probable that the air which is its basic material, is not a simple substance, an element, as the early physicists thought it to be; in the second place this fluid dissolves water and other volatile substances that are found in nature; in fact, I shall be in a position to show, in a memoir on the nature of the air that I have in course of preparation, that evaporation and distillation into the air are two things that are almost synonymous" (*O.L.*, 2, pp.6-7).

There is nothing of that, not a trace of it, in the original memoir (1769) or in the *Dissertation* (1771). As I have shown, in *The eighteenth century Revolution in Science—the first Phase*, LAVOISIER began to study intently the nature of the air in the year 1773. In a Memorandum, the date of which is the 20th February, 1773, he stated his decision to work upon the processes in which air is absorbed and evolved because not enough had been done in that direction; he mentioned HALES again and again, adopted his opinion that plants gain something from the air and expressed the opinion that the air is not an element.

The *Premier Mémoire*, in all other respects, might have been written at any time previous to the year 1773. It gives an account of the earlier work on the subject together with comments on that work. The change of water into earth was thought to have been proved in two ways: (1) by experiments on plants; (2) by operations in a laboratory.

1. VAN HELMONT (23), in a classical experiment, placed a quantity of earth in a pot and planted a willow in it; he watered the willow for five years making use of distilled water or rain-water. The dry earth, which had weighed 200 pounds, at the end of the five years was less by 2 ounces. The willow had weighed 5 pounds and its weight was 169 pounds: the increase in weight, amounting to 164 pounds, VAN HELMONT ascribed to the water.

Innumerable experiments, of a similar kind, were made by BOYLE, TRIEVAL, MILLER, GLEDITSCH and BONNET, DUHAMEL, KRAFFT, ALSTON. VALERIUS, so late as the year 1766, concluded that vegetation transforms water into earth.

LAVOISIER subjected the evidence for this conclusion to

(23) JEAN BAPTISTE VAN HELMONT (1577-1644).

destructive criticism. The amount of earthy matter that can be got from a plant is small relative to the weight of the plant. Not only was the change of water into earth repugnant to received ideas but the complexity of the problem had been ignored : water seems to change into other materials that are found in plants, into oils, resins, scents. It was not always stated, in accounts of experiments, that distilled water had been employed. Even the experiment of VAN HELMONT, in which rain-water and distilled water were used, was open to objection if the water was not absolutely free from earthy matter. Moreover, plants can obtain material from another source : LAVOISIER cited botanists—HALES, GUETTARD, DUHAMEL, BONNET—who had indicated that they obtain material by means of their leaves from the air.

2. Numerous men had studied the conversion of water into earth in the processes of a laboratory. BORRICHIUS (24) evaporated water obtained from various sources—rain, snow, hail—and obtained, always, a solid residue. He expressed the opinion that the process might be continued until all the water was turned into earth. GEOFFROI, ELLER, MARGGRAF, inclined to this opinion; BOYLE, BOERHAAVE, LEROY, were sceptical of it.

BOYLE (25) entered into argument, and he made experiments, on the transmutation of water into earth. His position on this subject has never been fully explained. KOPP stated it correctly, as one expects of him, but with great brevity (*Kopp*, 3, pp.264-5).

BOYLE, according to LAVOISIER's assertion, " concluded that water can be changed into earth by distillation " (*O.L.*, 2, p.8). This assertion calls for circumspection. " The cautious and doubting ROBERT BOYLE " is not so easily disposed of. A bare statement that he committed himself to this or to that conclusion must inspire doubt and is always to be received with caution.

Possibly LAVOISIER, without reading BOYLE on the subject in full—he did not read English easily—let himself be misled by NEWTON's statement : " Water by frequent distillations changes into fix'd Earth, as Mr BOYLE has try'd " (*Optics*, *Quest.*30). This statement is precisely accurate in using the word " tried " and not " proved." But NEWTON believed, as the context shows,

(24) OLAUS BORRICHIUS (1626-1690).
(25) ROBERT BOYLE (1627-1691).

that water is transmuted into earth. LAVOISIER might easily think that BOYLE agreed with NEWTON.

BOYLE took an intense interest in this question. He argued it, he ascertained and faithfully reported what others had done, he made reflections and suggestions and he made experiments.

BOYLE was ready, for the purposes of argument, to assume that water can be turned into earth. In *The Sceptical Chymist* (1661) he took the line—if you say that you can get earth from animal and vegetable bodies I shall say that I can get earth from water (*Boyle (Shaw)* (26), 3, p.349). There is an argument of a like kind in *Divers Experiments and Observations upon the Producibleness of Chemical Principles* (1680). VAN HELMONT had professed to be able to turn stone into salt and salt into water.

> " Since then he stops not at salt, but goes to a further transmutation; and concludes, that a stone doth not consist of salt, because that salt may be turn'd into insipid water; I say, that insipid water is not the first matter of bodies; since, by a further operation of the fire, that liquor it self may be turned into earth."...
>
> " And I shall here add an experiment, which seems to argue that ... clear water may, by the operation of the fire, be changed into another body " (*op. cit.*, p. 417).

The last sentence—it is the introduction to an experiment that will be mentioned in due course—is quoted for the sake of the phrase—characteristic of BOYLE—" which *seems* to argue."

BOYLE went into the question at length in *The Origin of Formes and Qualities* (1666). He had obtained earth on boiling water in a glass vessel. Hence he thought that

> " the earthy powder might be a transmutation of some parts of the water into that substance earth. Herein, also, I was encouraged further by a physician, who assured me, that he had frequently found such a white earth in rain-water, after distilling the same many times successively;... But the oddness of the experiment still keeping me in suspense, a very ingenious person, who had try'd various experiments upon rain-water, gave me such an account of his proceedings, as left (27) me but little scruple about this transmutation : for he solemnly affirmed, on experience, that rain-water, even after distillation in very clean glasses, near two hundred times, afforded him this white earth, and that more conspicuously

(26) *The Philosophical Works of the Honourable Robert Boyle, Esq., abridged*, etc., SHAW, 1725, 3 vols. I quote from SHAW rather than BIRCH because BOYLE, when quoted in full from BIRCH, takes up extra space to no advantage. Collation is necessary on crucial questions. I have compared the passages that I cite with the originals in BIRCH. It will be seen that I draw attention to two passages in SHAW's abridgement that come short of being faithful to the originals.

(27) The original says not " left " but " seemed to leave " (BOYLE, ed. by BIRCH, 2nd. ed., 1772, 3, p.108).

in the latter distillation, than in the former. And in comparing this powder with what I made myself, I found an agreement between them... My learned friend... hath procured of it near three quarters of an ounce from one ounce of water " (*op.cit.*, pp.266-7).

BOYLE, having examined the powder carefully, came to a decision of sorts : " the gravity of this powder, being added to its fixedness, and other qualities, justly entitles it to the distinction of earth " (*op.cit.*, p.267). But here SHAW fails to express BOYLE's cautious spirit because, perhaps, he was out of patience with it. BOYLE's decision was : " it may seem no great impropriety of language to call it earth " (BOYLE, ed. by BIRCH, 2nd ed., 1772 3, p.108).

BOYLE then proceeded to show that all the results " support the corpuscular principles." For the sake of an argument " we will, for a while, suppose this transmutation real." When certain long paragraphs, and the argument, had come to an end, BOYLE could return to his doubts.

" But to leave these reflexions, I would not have it thought strange that while I insist upon the many particulars, which seem to evince the change of water into earth, I should intimate a diffidence about it. For I must confess, that having unluckily lost a whole paper of the powder I had myself made; and having, unexpectedly, been obliged to remove from my furnaces, before I had gone thro' half the trials, I judged requisite in so nice a case; I have not yet laid aside all my scruples " (*Boyle (Shaw)*, 1, pp.267-8).

BOYLE therefore proposed certain inquiries :

" For, (1.) I would gladly know, whether the untransmuted rain-water, by the deposition of so much terrestrial matter, were grown lighter in specie than before,... (2.) It were also fit to know, whether the glass-body, wherein all the distillations are made, loses of its weight, anything near so much as the obtained powder amounts to... (3.) I could wish likewise, that it were more demonstrably shown, what is, on all hands, taken for granted, that distill'd rain-water is a perfectly homogeneous body : for, if it be not, many suspicions might be suggested about its transmutation into earth; and if it is, it will be very difficult to conceive, how a perfectly and exquisitely homogeneous body should, without any addition, or any seminal or plastic principle, be brought to afford a large quantity of a matter of much greater specific gravity than itself;..." *(ibid.)*

BOYLE was concerned, in his 4th inquiry, with the properties of the earth that was supposed to come from water. He remarked that this earth, when acid was added to it, effervesced and did not all dissolve.

BOYLE's experiment, that was alluded to earlier, is as follows :

" We put very pure and limpid water... into a new bolt-head... and sealing it up hermetically, we placed the vessel in a digestive furnace, and left it there above a year;..." [Small particles were observed to form in the water.] " And the longer the glass was kept in the digestive furnace, the more of this fine terrestrial substance was produced" (*op.cit.*, 3, pp.417-8).

BOYLE proposed those inquiries in the year 1666 and reported that experiment in the year 1680. It is noteworthy that, ignoring his own 2nd inquiry, he paid no attention in the experiment to the weight of the glass vessel and of the earth that was to be found in the water. The inquiries and the experiment lay open to everybody for many years and met with neglect. They had occurred to BOYLE and might occur to any man, of knowledge and good sense, who was giving his mind to the problem. LEROY's speculations might have been stimulated by the 3rd inquiry, as to whether or not distilled rain-water is a perfectly homogeneous body : there is no proof that they were so stimulated. LAVOISIER met BOYLE's inquiries and improved upon his experiment possibly without knowing it. It is certain that he was stimulated by LEROY. He stood in no need, because of his own work on Hydrometry, of the hint in the 1st inquiry to attend to the specific gravity of a water. He was capable, having LEROY's speculations and that work to go upon, of thinking out the subject for himself.

The position of BOERHAAVE (28) has not been clearly stated, not even by KOPP (*Kopp*, 3, pp.255-6). BOERHAAVE was convinced that the residue, which was obtained on distilling water, was foreign to the water. He suggested that the greatest part of it came from the dust of the air. That suggestion was refuted by MARGGRAF. Nevertheless, his main contention, that chemical operations are liable to be affected in unexpected ways, was undeniable. In his judgment, that water

" may, without the interposition of anything else, be by distillation converted into true earth, has not hitherto been shown by sufficient experience. I have learnt, by numerous examples, how apt men are to overlook things that mix themselves unexpectedly in chemical operations" (BOERHAAVE, *A new Method of Chemistry*, etc., trans. by SHAW, 3rd ed., 1753, p.452).

LAVOISIER, in the *Premier Mémoire*, drew attention to the

(28) HERMANN BOERHAAVE (1668-1738).

teaching of LEROY and made comments on it. He remarked that water, if it contains earth of which a small part separates at each distillation, as LEROY said, must gradually become free from earth and pure. Yet MARGGRAF had found that about as much earth separated in the 40th and in the 50th distillation as in the 1st (*O.L.*, 2, p.10).

The *Second Mémoire*

The original memoir and the *Second Mémoire* are the same in essentials. Most of the differences that exist between them arose because LAVOISIER, in writing his memoirs, paid unceasing attention to style. Numerous paragraphs are identical in the two memoirs or are different only in respect of verbal changes. He made a change in the structure of the memoir : a Table, in which are collected the data concerning the standard water and the other waters, and his considerations upon that Table, all which had preceded the account of the experiment with the pelican, were brought in after it. With reference to that experiment he made a change of another kind; he inserted the admission that he could not account for the difference, as regards fusibility, between glass and the residue obtained from the water : also, as already mentioned, the statement that he was repeating the experiment : " I am doing it even while this memoir is being printed " (*op.cit.*, p.26). Also, he drew attention to the importance of distilling water in an alembic made of metal. He acknowledged that, in his experiments, the standard had been distilled in an alembic made of copper and the rain-water in one made of glass (*op.cit.*, p.15, footnote). In the original memoir and in the *Dissertation* he had overlooked the bearing of this on his work.

(vi) The sequel

The doctrine that there are four elements was in an awkward state. Fire was unquestioned, alone of the four. LAVOISIER doubted if the air is an element and there is no reason to suppose that he was alone in this doubt. The great efforts that the older chemists made to obtain earth in the elementary state, as BAUMÉ (29)

(29) ANTOINE BAUMÉ (1728-1804).

admitted, were made in vain : BECHER recognised three kinds of earth and STAHL two (BAUMÉ, *Chymie expérimentale et raisonnée*, 1773, 1, pp.91, 94). Those who disputed the unchangeableness of water, DEFOUCHY said, had not done so without the support of some weighty reasons (*sans y être autorisés par des raisons assez fortes*, *H.A.R.S.*, 1767, 14).

The orthodox believers in the four elements had to make the best of the position. Ignoring the fact that LAVOISIER believed the air not to be an element—or recognising it—they could dwell with satisfaction on his conclusions regarding water. BAUMÉ, for instance, reported : " Mr LAVOISIER... has satisfied himself by very exact experiments that water does not change into earth " (BAUMÉ, *op.cit.*, p.74). DEFOUCHY, who weakened so far as to concur in LAVOISIER's opinion that the air is not an element —as BAUMÉ did not—expressed approval of his work upon water : it established (1) that the nature of water is not altered by distillation and (2) that glass is soluble in water. But he proposed various questions for him to take up and answer : for instance, " what is the proportion of sand and of fixed alkali in the soluble part of glass; is it the same for the earth dissolved in water and for the earthy sediment?" (*H.A.R.S.*, 1770, 7).

DEFOUCHY demanded too much. All that was needed, namely, a proof complementary to LAVOISIER's, SCHEELE could supply.

" I accept it as certain, that neither by art nor by nature can pure water, by itself, be converted into a dry material that has all the properties of a true earth. I am well aware that by frequently repeated distillations... an earth has been obtained. For me, it was not enough merely to read this; I must also see with my eyes so highly wonderful a conversion" (*The collected Papers of Carl Wilhelm Scheele*, trans. by DOBBIN, 1931, p. 88).

After having boiled water in a glass vessel SCHEELE found, on examining the water, that it contained the same materials that are present in glass. He made the water boil for 12 days and nights. Having let the suspended matter subside he examined the water and the sediment separately. He found that the water (1) with ammonium chloride gave ammonia; (2) with sulphuric acid coagulated; (3) precipitated metallic solutions; (4) turned syrup of violets a green colour and (5) when left in the air became a jelly. The sediment

" behaved like silex, mixed with very little lime. I broke the flask and found

the inside surface dim and without lustre... Could I doubt any longer that water can decompose glass by continued boiling?" (*op.cit.*, p.89).

He tried an experiment in which he used pulverised lead glass and obtained corresponding results.

This work was done before the year 1768 (*Carl Wilhelm Scheele, Nachgelassene Briefe und Aufzeichnungen*, ed. by NORDENSKJÖLD, 1892, pp.41, 413, 440-1). SCHEELE made the work known in the preface to his *Chemische Abhandlungen von der Luft und dem Feuer*, published in the year 1777. Why it was not made known earlier has not been explained and may depend upon the facts: (1) that the transmutation of water into earth was a current doctrine in Sweden: SCHEELE must have known that BENGT FERNER accepted it and (2) that SCHEELE, in the year 1771, believed that earth is formed by the interaction of hydrofluoric acid and water.

Objections to LAVOISIER's conclusions were made in various quarters. KOPP, in a review of the whole subject, drew attention to various conscientious objectors (*Kopp*, 3, pp.257-8) most of whom were obscure men. He was not aware of PRIESTLEY and of WATSON, Bishop of Llandaff.

PRIESTLEY (30), in the year 1775, was dissatisfied with LAVOISIER and also with BRYAN HIGGINS. He published a controversial pamphlet, directed against HIGGINS, which he called *Philosophical Empiricism containing remarks on a charge of plagiarism respecting Dr H...s interspersed with various observations relating to different kinds of air*. In this pamphlet, which is written, in the main, with great ability and to which HIGGINS never ventured a reply, PRIESTLEY touched, as a side-issue, on the conversion of earth into air and of water into earth.

PRIESTLEY had obtained oxygen from saltpetre. He took this as a proof that oxygen—or air—contains earth: in other words, that earth is convertible into air.

"Dr. H—s calls earth an inconvertible element, but I will undertake to convert the whole of a quantity of earth into what he shall be obliged to call air; and, provided it be pure earth, by which I mean free from phlogiston, it shall be respirable air" (*Philosophical Empiricism* etc., 1775, p. 57). "It is to be wished... that you would prove... that earth is not convertible into air, as I assert, and you deny" (*op.cit.*, p.71).

(30) JOSEPH PRIESTLEY (1733-1804).

PRIESTLEY dealt faithfully with HIGGINS over the conversion of water into earth.

"Dr. H—s asserts... that the pretended conversion of water into earth is an erroneous notion. But while he pretends to have considered the experiments of BOYLE, BORRICHIUS, WALLERIUS, LEIDENFROST, MARGRAAFF *(sic)* ELLER, and LAVOISIER (which is calculated to convey an idea of his extensive reading) he has overlooked the more decisive experiments of his countryman Mr. GODFREY, who converted the whole mass of a considerable quantity of distilled water into perfectly dry earth. For my own part I see no reason to doubt of the fact; and what is much more, Mr. WOULFE (31), who is unquestionably one of the ablest and most judicious chemists of the age, says that he has seen enough, in his own experiments, to make him perfectly satisfied with respect to it" (*op.cit.*, pp.56-7).

Mr GODFREY (32), I suppose, is the "very ingenious person" who almost persuaded BOYLE to believe in the transmutation of water into earth. PRIESTLEY consulted his grandson—AMBROSE GODFREY—and obtained from him some of the earth that the grandfather had produced from water. He made experiments with it and succeeded in obtaining fixed air from it. He was much impressed by this result because, presumably, it meant to him that not only is water convertible into earth but also earth into fixed air.

"Since the writing of this pamphlet Mr. GODFREY (of whom I made some inquiry concerning the conversion of water into earth ...) has been so obliging as to favour me with part of a quantity of earth that had been produced from distilled water, weight for weight, by that celebrated chemist, the contemporary of Mr. BOYLE, and his fellow-labourer.

"This earth, I find, yields fixed air in great plenty by the heat of a burning lens in quicksilver, as well as by means of the acids. And when it is made into a paste with spirit of nitre, it yields more air, the greatest part of which is fixed air. This experiment I barely announce at present, as exhibiting a new fact respecting the generation of fixed air, that cannot be published too soon" (*op.cit.*, *Advertisement*).

There is reason to think that PRIESTLEY came to abandon his belief in the transmutation of water into earth and of earth into air. Certainly he learnt that water attacks glass by going into the subject experimentally (*Experiments and observations relating to various branches of Natural Philosophy with a continuation of the observations on Air*, 1779, I, pp.406-10).

At the University of Cambridge, WATSON (33) was elected

(31) PETER WOULFE (1727?-1803).

(32) AMBROSE GODFREY HANCKEWITZ (?-1741).

(33) RICHARD WATSON (1737-1816).

Professor of Chemistry in the year 1764 and was appointed Regius Professor of Divinity in the year 1771. He was appointed Bishop of Llandaff in 1782. He published *Chemical Essays*, in 5 volumes, a work that reached to a 7th edition. Volume 4, which appeared first in 1786, that is, when he was a bishop, contains an essay entitled: ***Of the transmutation of water into earth***. He gave his own opinion upon the subject:

"I am rather disposed to believe that water is converted into earth; though I own that no experiment has yet been produced, to which reasonable objections may not be made. The point I am sensible cannot be decided by authority" (*Chemical Essays*, 7th ed., 1800, 4, pp.306-7).

WATSON made experiments.

"I have slowly distilled water in a silver retort, and afterwards evaporated the distilled water on a polished silver plate; there remained on the plate a small pellicle of earth. When a drop of water, arising from the vapour condensed in the top of a silver tea vase, (34) happens to fall upon the body of the vase, it is presently evaporated; but it always tarnishes the spot on which it has fallen. I am aware it may be contended, that the earthy pellicle in both these cases may be attributed to a precipitation of the dust floating in the atmosphere, or to an attenuated earth, which is mixed with the water, and carried up by the vapour. On the whole, the possibility of converting water into earth by distillation, remains, I think, still an undecided problem: M. LAVOISIER's experiment staggers the confidence I had reposed in the conclusions of MARGGRAF but it must be repeated with success before it will utterly subvert it" (*op.cit.*, pp.291-3).

Conclusion

After LAVOISIER produced his memoir on the Nature of Water in May, 1769, his output in science diminished. During almost three years he undertook only one investigation of importance. His early efforts at finding the heights of mountains and of strata, by the barometric method, did not satisfy his instinct for accuracy. He therefore resorted to the geodetic method. He made use of surveying instruments—a quadrant and a level—for ascertaining the heights of the hills near Paris: he was engaged in surveying Mont-Valérien, for instance, on the 28th March, 1771 (*O.L.*, 5, p.208). This work did not interest him deeply, I think, because he reported it to the *Académie des Sciences* many years later.

(34) I take a "tea vase" to mean what ordinary people call a teapot.

There are reasons for this small output. As an official he had to carry out the routine work of his office and, in addition, to master the business of the *fermes*. Time and again he was absent from Paris, on tour, attending to that business, sometimes for months on end (*Grimaux*, p. 33). One must not make too much of this. With his immense capacity for work he could carry on the routine of his office, and also the routine of a scientific investigation, efficiently and swiftly. He found time, whilst he was on tour, to make field-notes and to study the water-supply of Rouen. I cannot doubt that he would have found time to do more and better work but for the cardinal fact that inspiration had failed him.

LAVOISIER, by the year 1769, had exhausted the ideas on which he had been working. He had received inspiration, or hints, from others. He was stimulated by others if and when they were themselves active in thought and work—by LEROY, DÉPARCIEUX, GUETTARD. Having made the utmost of what he got from them he must next find inspiration for himself. Not until the year 1772 did he resume scientific work in earnest. He then began to study the chemical changes in which gas is absorbed and produced : in particular to study combustion.

That was the beginning of the second stage in LAVOISIER's career. One may say that the first stage ended then. But, in saying that, one is to bear in mind that during the last three years of it his output in science was small and, also, that he resumed later his early work in Meteorology, Geology, Hydrometry.

Much of the work that LAVOISIER did in that first stage is not of high intrinsic value. One can come to that conclusion on consideration of the work itself and also of the fact that he published little of it. He dallied with the thought of publishing : in the *Opuscules physiques et chimiques* he spoke of issuing other *Opuscules* that should contain such of his early work as was too bulky for publication in the memoirs of the Academy (*O.L.*, 1, pp.439-41). He drew up a scheme for a *Traité de l'Eau* that should contain his work on Hydrometry, the examination of natural waters, the density and the expansion of water, the Nature of Water (*op.cit.*, 3, pp.707-10). He was restrained by a fastidious judgment. Of all his work up to the end of the year 1771 he published only the first memoir on gypsum and the

memoir on the Nature of Water. He withheld the essay on Lighting, the second memoir on gypsum and the work on Hydrometry although all these had been passed for publication at the *Académie des Sciences*.

LAVOISIER had the instincts of a physical chemist. But the age he lived in was not ripe for physical chemistry : the basis for it in physics did not then exist. Those instincts appear in his measuring the solubility of gypsum and in his work on Hydrometry—the different hydrometers that he designed (each meeting a particular need)—his choice of a constant-immersion hydrometer for accurate work, his attempt to work at a standard temperature—and in his proposal to use water as a standard substance.

In LAVOISIER'S early work, the Hydrometry is by far the most important. It affords a clue to certain of his investigations that is indispensable for understanding them. It culminated in his work on the Nature of Water. In the course of that work, when he wanted to judge the purity of a water by its specific gravity, he employed, not any hydrometer, but one that he had designed with a view to accuracy : he used it, not as seemed best on the spur of the moment, but according to a technique that he had thought out more than a year before and practised continually.

LAVOISIER proposed to use the hydrometer in numerous ways. Once the necessary tables of specific gravity data were arrived at, it could be used to tell the strength of numerous solutions : of any salt, of any acid, of alcohol, in water : of a resin in an oil or in alcohol. He wanted, further, to base on specific gravity data the explanation of problems in chemistry : to study the action between an acid and a mild alkali : to ascertain the origin of the gas that was produced in that action : to study intimately the condition of a salt, and the action between two salts, in solution.

These proposals are indicated in one of the memoirs on Hydrometry (*op.cit.*, pp.159-60). What is said there is partly repeated and partly improved upon in the other memoir (*op.cit.*, pp.448-50). At the end of that memoir LAVOISIER remarked, regarding the problem of salts in solution :

"If the wit of man can penetrate these mysteries, it is by making researches

on the specific gravity of liquids that he may hope to succeed. The quantity of saline matter contained in the two liquids that are to be brought into combination with one another, the specific gravity before and after the combination, the comparison of their mean specific gravity with that which results from mixing them, next the consequences of similar experiments repeated on one and the same substance along with all the others, should yield a number of data sufficient to lead to a solution of the problem." (*op. cit.*, p. 450.)

That shows what LAVOISIER thought of doing with the hydrometer. One can see, in the *Opuscules physiques et chimiques*, what he did with it in the year 1773. The quantities of nitric acid that he needed in his experiments, as I have already said, he prepared all of the same strength by bringing the acid to the same specific gravity. Further, he related physical properties and chemical composition to one another. He founded arguments on specific gravity data that went far to settle questions that were then in controversy. He made experiments, which seem trifling now, that were thoughts, rendered perceptible to the senses, on what were doubtful and difficult subjects.

The problem of the day, for chemists, was the part that a gas can take in chemical change. Carbon dioxide, according to BLACK, made the difference between a caustic and a mild alkali: the caustic became mild by gain, and the mild became caustic by loss, of carbon dioxide.

LAVOISIER studied the effect of carbon dioxide upon the physical properties of substances. He found, using his silver hydrometer, that lime water is higher in density than water and that, on treating it with carbon dioxide, the resulting liquid is much the same as water in density (*op.cit.*, 1, pp.569-70). Using the same hydrometer he studied the conversion of sodium hydroxide into the carbonate and of the carbonate into the hydroxide. When carbon dioxide was passed into solution of the hydroxide the specific gravity of the solution increased; on adding slaked lime, gradually, to solution of the carbonate the specific gravity of the solution gradually fell (*op. cit.*, pp. 588, 579).

LAVOISIER wanted to accumulate evidence that phosphorus, on burning, gains something from the air. So he burnt phosphorus, let the product deliquesce and brought the resulting liquid to a convenient volume. From the weight of this liquid he deducted first the weight of its own volume of water and next the weight of the phosphorus. He found that the phosphorus,

154 *grains*, had attracted, during the combustion, at least 89 *grains* of one substance or another.

"This substance could not be water, because water would not have increased the specific gravity of water : it was then either the air itself or another elastic fluid contained, in a certain proportion, in the air that we breathe. This last experiment seems to me so conclusive that I do not foresee on what grounds it could be attacked" (*op.cit.*, p.651).

LAVOISIER, in the first stage of his career, ensued such subjects of work as occurred to him. In the remainder of his career he made his own choice of subjects. Otherwise the first stage is consistent with the better known remainder. His record, in that stage, makes manifest the zeal with which be would pursue a subject. It is interesting, above all, because it exhibits talent and energy exerted with love of science and of fame as the motives. He was earnest in making efforts for the advancement of science and in applying science so as to meet civic and national needs. The schemes of work that he laid down show a wide outlook and were carried through with intense energy. He took up varied problems, small as well as large, and liked to recur to any problem that he had once touched. He took a keen pleasure in making experiments and in demonstrating them. He liked to make his work known, explained his ideas and described his experiments to perfection and showed wisdom in deciding what to publish and what to withhold from publication.

This paper gives a view of LAVOISIER's early work as a whole and in its various aspects and proves that work to be worthy of more attention than had been paid to it. I believe that the work, in every aspect, admits of further study.

I have had the privilege of access to the archives of the *Académie des Sciences* for the purposes of this paper and, in particular, to the *Lavoisier MSS.* For this privilege I am indebted to *MM. les secrétaires perpétuels de l'Académie des Sciences.* I make cordial acknowledgment of what I gained from Dr PAUL DORVEAUX, the *archiviste*, during my work in those archives. I benefited by his abundant knowledge of the *Académie des Sciences* in the eighteenth century and received assistance from him, again and again, in deciphering manuscripts.

My thanks are due to Mr. FRANK C. NICHOLSON, the Librarian

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Morningside, Edinburgh. A. N. MELDRUM.

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Goethe et Quetelet. Leurs relations de 1829 à 1832

« Il semble que la nature ait voulu réunir en lui (GOETHE) et montrer tout ce qu'elle peut accomplir en créant une personnalité humaine capable d'atteindre au sommet le plus élevé : et qu'elle l'ait à cet effet placé précisément dans les conditions d'atavisme et de milieu les plus propres à réaliser ce dessein. Non seulement, elle l'a doté de toutes les qualités de l'intelligence la plus ouverte et la plus féconde, de l'esprit d'observation le plus vaste et le plus pénétrant, curieux de tout, mais elle lui assura tous les avantages qui résultent de la naissance d'une part, de la beauté physique, de l'autre.

« Né dans une ville libre, dans un pays de penseurs, issu de l'élite de la bourgeoisie, riche et influente, affranchi dès l'enfance de toutes les préoccupations matérielles, pouvant se livrer sans obstacles à ses études et à ses goûts de prédilection, entouré de très bonne heure des plus sages conseils, des dévouements les plus sincères, GOETHE n'a qu'à se laisser conduire par sa destinée dont il sait en toutes circonstances maintenir l'équilibre (1) ».

Son œuvre scientifique est considérable. Elle est représentée dans la grande édition de Weimar par treize gros volumes, et elle prouve que l'auteur de *Faust* s'est intéressé à toutes les branches de la science de son temps : botanique, minéralogie, géologie, paléontologie, zoologie, ostéologie, anatomie et anatomie comparée, météorologie, chimie, physique, astronomie, sans parler de l'alchimie et de la phrénologie; tous ces domaines l'ont attiré, il les a exposés plus ou moins profondément, avec plus ou moins de bonheur, mais avec une presque égale curiosité et un égal désir de comprendre et d'expliquer, de trouver les lois stables,

(1) Cf. CH. SIMOND, *Goethe* (1749-1832), p. 15.

les lois profondes derrière l'infinie diversité des phénomènes, derrière le chatoyant et mouvant rideau des apparences (2).

Ajoutons : le dessin, des notions d'architecture, et une science nouvelle mise à la mode par le philosophe suisse LAVATER (1741-1801), la « physiognomique ».

On allait fêter le LXXXe anniversaire de naissance de GOETHE (le 28 août 1829). Une brillante cohorte de savants, d'artistes, de littérateurs étrangers se trouvait réunie à Weimar. On y notait la présence du poète dramatique CHARLES DE HOLTEI (1798-1880), du poète polonais ADAM MICKIEWICZ (1797-1855), du sculpteur français PIERRE-JEAN DAVID D'ANGERS (1788-1856). Parmi eux se trouvait ADOLPHE QUETELET, accompagné de MADAME QUETELET. Il avait entrepris un voyage en Allemagne dans le but d'y visiter les principaux observatoires, et désireux de saluer « le vaste génie qui semblait répandre ses derniers rayons sur l'Allemagne », il venait d'arriver à Weimar (3).

L'accueil de l'illustre vieillard fut plein de bienveillance. GOETHE s'informa avec bonté du but du voyage de QUETELET, voulut voir l'appareil au moyen duquel celui-ci observait l'intensité magnétique, l'engagea pour faire ses expériences à disposer du jardin situé près du parc de Weimar, et le pria de lui faire connaître le résultat de ses observations. Ce jardin était situé sur le penchant d'une colline d'où l'on apercevait le beau panorama du parc de Weimar jusqu'au belvédère, résidence d'été du grand-duc de Saxe-Weimar.

Le 29 août eut lieu au théâtre de Weimar, une première représentation de *Faust*, modifiée avec l'approbation de l'auteur, par le célèbre littérateur LOUIS TIECK (1775-1853).

« ... Je fus assez heureux, ajoute QUETELET (4), pour passer avec GOETHE presque toute la journée qui suivit cette représentation ; il continua de me montrer avec bonté ses expériences relatives à la lumière, ainsi que la collection de ses divers instruments ; ce qui faisait que la chambre où nous nous trouvions ne ressemblait

(2) Cf. H. LOISEAU, *De l'œuvre scientifique de Goethe*, etc., p. 305-306. (*Mémoires de l'Académie des Sciences, Inscriptions et Belles-Lettres de Toulouse*, deuxième série, tome VIII, 1930.)

(3) Cf. A. QUETELET, *Sciences mathématiques et physiques chez les Belges au commencement du XIXe siècle*. Bruxelles, 1866.

(4) Cf. A. QUETELET, *Opus citat.*, p. 659-660.

pas mal à celle du docteur Faust, comme l'observait en plaisantant sa belle-fille. Ma mémoire n'a rien perdu de ces entretiens pleins de charme, pleins d'abandon; ils seront toujours présents à ma mémoire ».

Le professeur V. JOHN, d'Innsbruck a dit : « Le récit de cette visite à GOETHE met en lumière l'influence profonde et toute puissante qu'exercèrent les courts entretiens personnels de QUETELET avec le héros de l'esprit allemand, sur le développement intime du jeune physicien belge, et plus tard, sociologue » (5).

GOETHE tenait des réunions du soir où, seules, quelques personnes étaient admises. QUETELET profita avec empressement de la faveur qui comblait tous ses désirs.

Au cours de l'une de ces soirées, QUETELET amena la conversation sur des sujets intéressant particulièrement GOETHE : « Je lui parlai successivement des différentes circonstances de ses voyages et de ses écrits les plus estimés, mais sans trop exciter son attention et sans lui donner l'envie de prendre une part trop active à l'entretien; cependant lorsque je vins à parler de Venise, de sa jeunesse et de ses premières compositions, je compris que j'avais touché un sujet qui l'intéressait; bientôt je pus m'arrêter et je vis successivement tous les conviés s'arrêter autour de nous. L'illustre auteur avait sans doute compris le désir de son jeune admirateur et celui de toute l'assemblée. GOETHE dont la noble figure faisait naître le respect et dont le langage avait quelque chose de brillant et d'inspiré, parla avec une éloquence réelle des premiers souvenirs de sa jeunesse, de ses premiers temps qui lui permettaient de rappeler ce que sa carrière avait eu de plus brillant et de plus animé; il était vraiment poète et il était aisé de voir que les sentiments qu'il exprimait avaient pénétré dans le cœur de tous ses auditeurs ».

Cependant les conversations particulières entre GOETHE et QUETELET portèrent spécialement sur les sciences naturelles.

Pendant son jeune âge, GOETHE fut initié par Mᵉˡˡᵉ DE KLETTENBERG (1723-1774) aux sciences occultes et aux mystères de l'alchimie; elle lui donna l'accès de son laboratoire où se trouvaient réunis des cornues et des alambics, ce qui lui fournit l'inspiration des premières scènes de *Faust*. Sa pensée fut dirigée vers les sciences

(5) Cf. V. JOHN, *Quetelet bei Goethe*, p. 314. Iena, FISCHER, 1898.

naturelles, qui, dès lors, ne cessèrent de l'attirer. Cet épisode devait avoir plus tard une répercussion sur la marche de ses grands travaux scientifiques.

GOETHE attachait plus de prix à ses découvertes dans le domaine de l'anatomie et de la physique qu'à *Faust* ou à *Werther ;* il croyait surtout par elles s'attirer la reconnaissance de la postérité.

Une grande partie de son activité scientifique a été consacrée à l'étude de la physique, mais principalement de l'optique (6).

De 1786 à 1832, il en fait l'objet incessant de ses recherches. L'idée de faire des études sur la nature physique des couleurs lui vint au cours de son voyage en Italie où il eut l'occasion de contempler les chefs d'œuvre des maîtres de la peinture et où il put ainsi se rendre compte des lois et des effets du coloris (7).

« On sait avec quelle précision scientifique et quelle puissance d'imagination, il (GOETHE) décrit les phénomènes physiques. Il y a dans la première scène du second *Faust* une description d'un lever de soleil qui répond à des souvenirs personnels du poète, et rappelle toutes les magnificences des paysages alpestres si souvent observés par lui » (8).

A propos de sa *Théorie des couleurs*, les idées de GOETHE n'ont pas été généralement accueillies d'une manière favorable. Il prétendait obstinément que NEWTON s'était trompé.

« Comme poète, mon chemin est fait, disait-il à QUETELET, je puis le parcourir avec assurance, mais comme physicien, il n'en est pas de même et les opinions peuvent varier beaucoup au sujet de mes recherches ».

Venu à Weimar pour un jour, QUETELET s'y trouvait depuis une semaine, il devait assister au congrès scientifique qui allait se tenir à Heidelberg à partir du 18 septembre 1829.

« Vous allez donc à Heidelberg pour assister à ce grand bazar scientifique (le congrès), lui dit GOETHE; chacun y viendra étaler sa marchandise, la prisera fort et dépréciera peut-être celle du voisin. Or, je suis un voisin, moi; et j'avoue que je serais assez curieux de savoir ce qu'on pense de cette marchandise et si l'on y trouve quelque estime. Me promettez-vous de me dire la vérité ?

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(6) Cf. CH. SIMOND, *Op. citat.*, p. 84.
(7) Cf. CH. SIMOND, *Op. citat.*, p. 84.
(8) Cf. A. MEZIERES, *Goethe*, t. II, p. 374.

« Je lui répondis qu'il pourrait l'attendre pleine et entière. « Cela me suffit, dit-il, je compte sur votre promesse » (9).

« Je veux vous donner, avant votre départ, la preuve d'un talent qu'on ne me suppose certainement pas. Je mets un amour-propre tout particulier, ajouta-t-il en souriant, à savoir faire un paquet; et, en effet, il s'occupa de ranger les pièces qu'il me destinait, ainsi qu'à ma femme, sous une enveloppe que j'ai toujours conservée soigneusement depuis, comme un des présents les plus précieux que je tiens de lui. Qu'on pardonne ces petits détails que le souvenir du grand poète fera peut-être excuser. Sur un carton de format in-8°, il déposa d'abord l'intéressant ouvrage *Zur Naturwissenschaft überhaupt besonders zur Morphologie*, Stuttgart und Tübingen, 1820, et, sur la couverture, il écrivit ces mots pleins d'amitié : *Herrn Direktor Quetelet, zu geneigtem Andencken des 28. Aug. 1829. Der höchst erfreulichen Unterhaltungen nicht zu vergessen*, GOETHE.

« Entre les feuillets du livre, il plaça six verres colorés plans de sept centimètres de hauteur sur quatre de largeur pour les expériences lumineuses et pour démontrer ses idées sur des effets de polarisation, qu'il considérait d'une manière toute particulière et avec des expressions qui lui étaient propres; puis les quatre vers français suivants, qu'il destinait à ma femme. Ils étaient tracés de sa main, avec une écriture ferme qui semblait appartenir au burin plus qu'à la plume d'un octogénaire :

> Chaque jour est un bien que du ciel je reçoi,
> Profitons aujourd'hui de celui qu'il nous donne;
> Il n'appartient pas plus aux jeunes gens qu'à moi,
> Et celui de demain n'appartient à personne.

« GOETHE replia ensuite son paquet; il y apposa son cachet et remplit toutes les formalités voulues, pour me donner, disait-il gaiement, une idée de son savoir en fait d'expédition. Ces détails pourront étonner et on ne les soupçonnerait point chez l'auteur de *Werther*, de *Faust*, d'*Egmont*, etc., surtout si l'on se rappelle la réputation de cet homme éminent.

« Quand il fallut le quitter, vers la fin de la même soirée, et lui faire mes derniers adieux, les paroles me manquèrent; le bon

(9) Cf. A. QUETELET, *Op. citat.*, p. 662-663.

vieillard s'en aperçut et il m'embrassa avec la tendresse d'un père. Je ne pense pas avoir été jamais plus vivement ému, et plusieurs jours après mon départ, j'avais encore ce même sentiment de tristesse. Il était aussi bien vivement éprouvé par ma femme, qui conserva avec Mme OTTILIE GOETHE (10), la belle-fille du célèbre poète, une correspondance amicale pendant le reste de sa vie ».

QUETELET assista au Congrès d'Heidelberg où il rencontra notamment le professeur ROUX (1771-1830) qui s'occupait alors d'expériences d'optique et dont les idées se rapprochaient beaucoup de celles de GOETHE. Lors d'une séance de la section de physique du Congrès, il fut question de la théorie des couleurs; j'ai encore trop peu approfondi (11), dira QUETELET, dans la description de son voyage en Allemagne, les écrits de l'illustre vieillard de Weimar pour oser me prononcer à cet égard; mais j'ai recueilli avec intérêt les expériences que j'ai vu produire des deux parts, abstraction faite de toute considération de théorie. Les recherches de M. ROUX ont paru à Heidelberg, en trois livraisons successives, sous le titre *Die Farben* (12).

« ... J'eus le grand avantage, continue QUETELET, en lui parlant de ce qui le concernait, de pouvoir l'entretenir du véritable enthousiasme avec lequel avait été portée sa santé dans le diner général de tous les savants, qui couronna cette brillante assemblée. Nous étions tout près de Francfort, patrie heureuse d'un illustre écrivain, et l'Allemagne était fière de pouvoir proclamer un nom si intimement lié à sa gloire littéraire.

« Je fus heureux, de mon côté, je l'avoue, d'avoir été désigné par ce grand poète, pour le mettre confidentiellement au courant de ce qui s'était passé à Heidelberg et du véritable triomphe dont il avait été l'objet.

« Ce ne fut néanmoins que quelque temps après que je reçus de Weimar une lettre amicale qui m'annonçait que ma lettre avait été reçue et que deux personnes que j'avais pris la liberté de lui adresser successivement, avaient été accueillies obligeamment par lui.

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(10) Née VON POGWISCH.

(11) Cf. A. QUETELET, *Notes extraites d'un voyage scientifique en Allemagne* (*Correspondance physique et mathématique*, tome 6, page 233.)

(12) Cf. A. QUETELET, *Op. citat.*, p. 665.

Lettre de Goethe à Quetelet. Traduction.

« Ne croyez pas, mon cher Monsieur, que mon silence exprime un ingrat oubli; je me souviens, au contraire, de cœur avec les miens, de ces jours que vous avez bien voulu, avec votre chère épouse, passer parmi nous, en retardant votre départ.

« L'intérêt que vous avez porté à mes idées, à ma manière de les envisager et de les coordonner, a été pour moi d'une grande importance. J'ai continué de les considérer avec plus d'attention et tâché de les traiter avec plus de soin. Les livres que vous m'avez envoyés m'ont été également très utiles; j'y ai beaucoup puisé, et par l'examen des principes qu'ils contiennent, j'ai appris à mieux apprécier ma propre manière de voir...

« J'ai appris avec d'autant plus de plaisir que vous vous proposiez de faire un voyage en Italie, que je pouvais espérer de vous y voir rencontrer mon fils qui venait précisément de s'y rendre aussi. J'ai été peiné d'apprendre qu'un triste évènement vous ait empêché d'entreprendre ce voyage tant désiré.

« Ma bonne fille vous présente ses meilleurs compliments, ainsi qu'à Madame votre épouse, en vous assurant que les journées charmantes et instructives dont vous nous avez honorés, nous ont laissé le plus agréable souvenir. Portez-vous bien et donnez-nous quelquefois, par un voyageur obligeant, le témoignage d'un souvenir durable et d'un attachement inaltérable. Je suis avec la plus haute estime

Votre dévoué (sé) J. W. GOETHE. »

Weimar, 24 mai 1830.

« Cette lettre est un des souvenirs les plus précieux que j'ai conservés; je sentais parfaitement l'extrême bonté du noble vieillard pour un jeune homme qui n'avait aucun titre qui pût le recommander à tant de bienveillance; mais ces sentiments eurent peut-être quelque influence sur mon avenir; je ne pouvais les oublier devant les souvenirs historiques qui m'avaient tant frappé » (13).

Il est intéressant de rechercher l'influence réciproque qu'ont pu exercer l'un sur l'autre ces deux esprits d'élite, GOETHE et QUETELET.

(13) Cf. A. QUETELET, *Op. citat.*, p. 667-668.

Le professeur V. JOHN, d'Innsbruck affirme que le poète allemand a fait au jeune physicien belge la critique très claire de ses propres travaux de sciences naturelles, que les idées fondamentales contenues dans ces travaux ont servi de base à la nouvelle science de la morphologie et à l'idée centrale de la conception de l'Univers. Il se fait que l'idée fondamentale des œuvres socialo-physiques de QUETELET se retrouve développée par GOETHE dans sa Morphologie et exprimée symboliquement dans la seconde partie de *Faust* (14).

Pour GOETHE, « toutes les choses concrètes, individuelles, ne sont que l'image d'un prototype, d'un type original dont descendent aussi bien les différentes parties d'un même organisme dans le monde animal et végétal, que les différences dans la structure anatomique des différentes espèces animales et végétales de la Création » (15).

Il paraît bien établi d'après le compte-rendu de la visite de QUETELET à GOETHE que celui-ci enthousiasmé a discuté à fond avec l'hôte belge l'idée fondamentale dominant complètement sa pensée. La preuve en est la remise à QUETELET d'un exemplaire de la Morphologie de 1820, « en souvenir des entretiens très joyeux ».

Il est certain que l'idée du type de GOETHE devait fortifier l'étude anthropologique de l'origine unitaire du genre humain.

« L'homme moyen de QUETELET est le type de GOETHE, le modèle que les individus par la culture et leur développement moral et intellectuel, cherchent à atteindre toujours davantage... » (16).

V. JOHN résume de la manière suivante l'influence de GOETHE sur les idées scientifiques de QUETELET : « Une loi d'après laquelle tous les êtres vivants se sont développés depuis des millions d'années; la théorie actuelle de la descendance dans le sens idéalistique, prédit par l'idée du développement d'après une loi déterminée jusqu'au degré le plus élevé de la Création, jusqu'à l'homme de Goethe, ce système d'idées, l'astronome belge, hautement doué pour les mathématiques et pour l'art, se l'assimila pour

(14) V. JOHN, *Op. citat.*, p. 319 et 321-322.
(15) Cf. V. JOHN, *Op. citat.*, p. 322.
(16) Cf. V. JOHN, *Op. citat.*, p. 325.

sa nouvelle science de l'homme dans son développement typique légitime (17).

« Poussé par cette conception monistique de l'Univers, QUETELET cherche, par analogie à la Morphologie de la Nature organique de GOETHE, à fonder la nouvelle science de l'homme « qui a pour sujet la recherche de l'homme dans ses différents liens et dans ses divers degrés d'aggrégats, depuis l'état de l'individu jusqu'à celui du lien le plus élevé de la société, embrassant toute l'humanité (18).

Le 22 mars 1832, GOETHE mourut à Weimar. Dans la nuit du 15 mars, l'illustre vieillard fut pris d'un fort refroidissement. Après une amélioration passagère, le mal s'aggrava fortement le 20; le malade souffrait de froid et d'oppressions; le pouls devint extraordinairement fréquent.

Le 22 mars, GOETHE se sentait très malade. Il ne pouvait plus rester au lit, mais devait se reposer sur une chaise à bras, dont il ne se levait que rarement avec une grande difficulté. Lorsqu'il connut la date, il pensa au début du printemps et s'exclama : « Ainsi le printemps a commencé, et nous pouvons alors nous rétablir plus tôt. » Bientôt son esprit se brouilla; il désirait manger, mais n'était plus capable de rien retenir en lui. Seule sa belle-fille OTTILIE était près de lui au moment critique, à 11 heures et demie. Il n'a pas quitté le monde par une grande phrase; le « Mehr Licht » (Plus de lumière) que lui ont prêté ceux qui par là croyaient l'élever, n'a pas été prononcé par lui; ses dernières paroles intelligibles furent adressées à sa belle-fille, en remerciement affectueux pour les soins fidèles, une tendre manifestation de son amour : « Viens, ma petite fille, et donne-moi la patte » (19).

Voici la traduction de la lettre de faire part du décès du glorieux littérateur allemand (20) :

« Hier matin, à 11 heures et demie, est mort mon beau-père bien-aimé, le Conseiller secret grand-ducal de Saxe et Ministre d'État JOHANN WOLFGANG VON GOETHE après une courte maladie,

(17) Cf. V. JOHN, *Op. citat.*, p. 328.
(18) Cf. V. JOHN, *Op. citat.*, p. 334.
(19) Cf. L. GEIGER, *Goethe*, p. 488.
(20) Cf. L. GEIGER, *Op. citat.*, p. 487.

une apoplexie pulmonaire, en suite d'une fièvre nerveuse, devenue catarrhale.

« Plein de force intellectuelle et affectueux jusqu'au dernier souffle, il nous quitta dans sa quatre-vingt troisième année.

Weimar, 23 mars 1832.

(sé) Ottilie von Goethe, née von Pogwisch,
Comme au nom de mes trois enfants
Walter, Wolf et Alma von Goethe.

(Observatoire Royal de Belgique.) Auguste Collard.

Geometrie und Prähistorie

Es sind in letzter Zeit mehrfach Beziehungen zwischen mathematischen Grundbegriffen und künstlerischem Ornament aufgewiesen worden. So hat SPEISER (1) ausgeführt, dass die ägyptische Linien- und Flächenornamentik angewandte Gruppentheorie und somit eine Art ältester Beitrag zur „höheren Mathematik" sei. Ich selbst habe (2) für den Gruppencharakter des Linienornaments hauptsächlich Beispiele aus der prähistorischen Keramik herangezogen. DEHN (3) betont in einem Aufsatz die Bedeutung des Rhythmus für die Entstehung der Geometrie und weist in diesem Zusammenhang gleichfalls auf die prähistorische Ornamentik hin. Mir will scheinen, als ob eine mathematische Diskussion der prähistorischen Verzierungen auch für die Prähistorie selbst von Bedeutung sein könnte. Es wird z.B. kein Zufall sein, dass das geometrisch interessante Motiv des von 6 kleinen Kreisen umgebenen Kreises, wobei alle Kreise gleichen Radius haben und Nachbarkreise sich berühren, sich ebenso in der kretischen Kultur wie etwa am Goldschmuck der Eisenzeit (Fund Rothengrub in Niederösterreich) findet, dass die Zeichnung eines Wagens in der Grundriss-Aufriss-Mischdarstellung (Räder und Pferde im Aufriss, Wagenkasten und Deichsel im Grundriss) an den verschiedensten Stellen auftritt. Andererseits erscheint es mir mathematisch von Bedeutung, dass ein Muster, wie es Fig. 1 darstellt, räumlich als Faltband zu deuten ist. Das Muster kommt ebenso auf neolithischen Tongefässen (z. Z. Butmir in Bosnien) als auf Kunstwerken der babylonischen Ur-Zeit vor.

Ich möchte im Folgenden nicht auf die besonders für den

(1) A. SPEISER, Theorie der Gruppen von endlicher Ordnung, 2. Aufl. Berlin, SPRINGER, 1927.

(2) W. LIETZMANN, Mathematik und bildende Kunst, Breslau, HIRT, 1930.

(3) M. DEHN, Das Mathematische im Menschen, *Scientia* 52 (1932) S. 125 f.

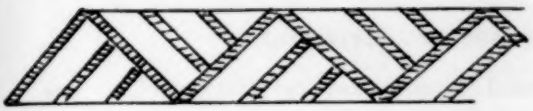

fig. 1

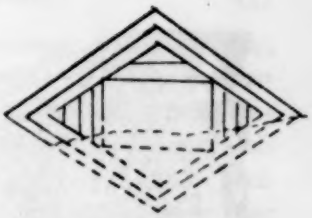

fig. 2

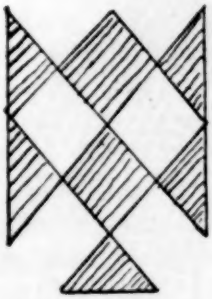

fig. 3

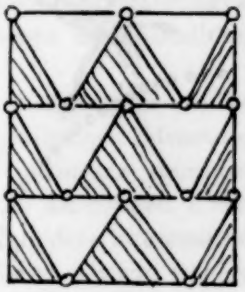

fig. 4

Fig. 5

Fig. 6

W. Lietzmann.

sog. „Umlaufstil" (4) bedeutsame Linienornamentik eingehen, sondern auf Beispiele einer dem „Rahmenstil" angehörenden Flächenverzierung. Das Beispiel ist der Hallstatt-Zeit entnommen, die etwa von — 1000 bis — 500 anzusetzen ist. Geometrisch bemerkenswerte Figuren aus jener Zeit sind nicht selten. Ich zeige etwa ein Rautenmuster aus einem Pfahlbau im Leibacher Moor (Fig. 2). Häufig ist ein Dreieck, in das ein Feld kongruenter Rauten eingezeichnet ist, wobei die einzelnen Elemente abwechselnd schraffiert und nicht schraffiert sind. Gefässe aus Salem (Museum Karlsruhe) zeigen sehr exakt ausgeführte Rechtecke mit Rauten- und Dreiecksausfüllungen, ebenso ein Gürtelblech aus der Oberpfalz (5).

Sehr ergiebig ist nun ein umfangreicher Satz von 40 cm bis 60 cm hohen Urnen des Wiener Naturhistorischen Museums, die aus Brandhügeln bei Ödenburg in Westungarn stammen. Ich habe geradezu den Eindruck, als ob hier an einigen Urnen ein an abstrakten geometrischen Formen besonders interessierter Künstler gearbeitet und übrigens an anderen Urnen weniger glückliche und verständnisvolle Nachahmer gefunden hat. Mehrfach treten die beiden Rechteckflächenausfüllungen (Fig. 3 und 4) auf. Am bemerkenswertesten vom geometrischen Standpunkt aus ist aber die Verzierung einer der grossen Urnen, die in Fig. 5 gegeben ist. Ich bitte nicht so sehr auf die in Dreiecksformen gegebene Darstellung von Menschen zu achten (6), worüber man bei HOERNES S. 558 ff. nachlesen mag. Ich bemerke nur, dass die eine Person an einem Webstuhl arbeitet, die andere ein Senkblei in der Hand hat. Sehen wir uns aber das Dreiecksornament etwas genauer an. Es ist in Fig. 6 nicht ganz genau, aber doch

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(4) Vergl. M. HOERNES, Urgeschichte der bildenden Kunst in Europa, Wien, SCHROLL, II. Aufl. 1915. Ich habe das Buch für das Folgende weitgehend benutzt; leider stand mir die 3. von O. MENGHIN herausgegebene Auflage von 1925 nicht zur Verfügung. Ich bin dem jetzigen Herausgeber des Werkes, dem Direktor des Naturhistorischen Museums in Wien, Herrn Prof. MENGHIN, für sein Entgegenkommen bei einem Besuche des Wiener Museums und insbesondere für die Bereitstellung der Figuren 5 und 6 zu grossem Danke verpflichtet..

(5) Vergl. C. SCHUCHARDT, Vorgeschichte von Deutschland, München, OLDENBOURG, 1928, S. 176, 181.

(6) Absichtlich bin ich auf die Frage nicht eingegangen, ob das geometrische Ornament auf Stilisierung bildlicher Darstellung des Menschen oder anderer Naturobjekte zurückgeht oder auch ob es sich um Kultsymbole handelt; beides scheint mir, zumindest in dieser Allgemeinheit, zweifelhaft.

für das Folgende exakt genug wiedergegeben. Wir finden hier — ich will es einmal modern ausdrücken — Beispiele für den Satz vom Flächeninhalt ähnlicher Dreiecke. Dreimal ist der Fall gezeigt, dass durch Unterteilung der Dreiecksseiten in 3 gleiche Teile und Ziehen von Parallelen zu den Dreiecksseiten der Flächeninhalt in $3^2 = 9$ Dreiecke zerfällt, zweimal haben wir den Fall, dass die Unterteilung der Seiten in vier gleiche Teile $4^2 = 16$ Teildreiecke liefert; der eine Versuch, auch die Seitenteilung in 5 Teile zu behandeln, ist missglückt. Die Unsicherheit des Zeichners ist am Original deutlicher zu sehen, als in der Wiedergabe in Fig. 6. Er beginnt von der Spitze aus richtig mit 1, dann mit einer Reihe von 3 und mit einer Reihe von 5 Dreiecken. Jetzt macht er zwei parallele Striche. Die folgende Dreiecksreihe sollte 7 Dreiecke haben, sie hat aber nur 6 und die letzte hat statt 9 Dreiecken nur 7.

Man stosse sich nicht allzusehr an den Ungenauigkeiten der Zeichnung. Der Künstler hat es auf der gekrümmten Fläche der Urne nicht so leicht wie der Zeichner auf dem Papier und doch möchte ich fast sagen, dass er besser zeichnet als der Mathematiker, der auf dem ägyptischen Papyros neben seinen Text eine sehr, sehr rohe Skizze setzt. Allerdings machen andere Papyroszeichnungen einen besseren Eindruck, lassen aber vermuten, dass sie mit dem Lineal gezeichnet sind (7).

Wer als Mathematiker an unser Ornament herantritt, wird noch an einer anderen Stelle einzugreifen suchen. Zeigen die als Füllsel der Dreiecke benutzten kleinen Kreise eine mathematische Gesetzmässigkeit? Ich wiederhole, dass die Zeichnung die Verhältnisse nicht ganz genau wiedergibt, aber immerhin so, dass man die Nachprüfung statt am Objekt selbst auch an ihr vornehmen kann. Wir finden mehrfach von der Dreiecksspitze ausgehend als Kreisanzahlen in den aufeinanderfolgenden Reihen 1, 2, 3, 4, 5, 6 Kreise, aber dann wird es schon unsicher, es folgen etwa gleich 8. Manchmal tritt der „Fehler" schon vorher auf. Die Vermutung, dass es sich hier um — empirische — Konstruktionen der Dreieckszahlen $1,\ 1 + 2 = 3,\ 1 + 2 + 3 = 6,$

(7) Ich verweise auf die Abbildungen in O. NEUGEBAUER, Die Geometrie der aegyptischen mathematischen Texte, *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik*, B. 1 (1931) S. 413 ff.

$1 + 2 + 3 + 4 = 10$ usf. handelt, also um das mit jener Flächenaufteilung verwandte Problem ist hiernach vielleicht etwas kühn.

Vielleicht wird der eine oder andere den Versuch einer Verbindung zwischen Prähistorie und Geometrie mit einem Lächeln abtun; man vergisst, dass es sich um eine Zeit handelt, in der an anderen Stellen die Beschäftigung mit abstrakten geometrischen Figuren schon lange vorher historisch bezeugt ist, dass ferner der geometrische Stil der Dipylon-Vasen im griechischen Kulturkreis (ca. -1000) auf eine parallele Erscheinung hinweist, dass schliesslich die Handelsbeziehungen jener Zeit weit stärker entwickelt waren, als man gemeinhin annimmt (8).

Mir scheint das aber alles noch in einer anderen Hinsicht bedeutsam. Der Ursprung der Mathematik wird vielfach aus den Bedürfnissen des täglichen Lebens (Feldmessung, Hausbau, Kulthandlung) hergeleitet, so wie es schon HERODOT von den Aegyptern sagt. Mir will scheinen, als ob ebenso ein Gefühl aesthetischer Freude an der reinen geometrischen Form eine Quelle der Mathematik gewesen ist. Es wäre im Hinblick darauf erwünscht, wenn diesen Beziehungen zwischen Ornament und geometrischer Figur in der Prähistorie weiter nachgegangen würde. Ich will nur darauf hinweisen, dass merkwürdigerweise ebenso wie in der systematischen Geometrie auch im Ornament das Dreieck vor dem Viereck, der Rhombus und das Rechteck vor dem Quadrat betont zu sein scheint.

(Göttingen.) W. LIETZMANN.

(8) H. SCHAAL, Vom Tauschhandel zum Welthandel, Leipzig, TEUBNER, 1931.

Notes and Correspondence

I. QUERIES.

Query no. 27.—*Antonio Cermisone über die Pest.*

MATHIAS DE GORKA, Arzt des polnischen Königs KAZIMIERZ JAGIELLONCZYK, verfasste um das Jahr 1450 einen *Tractatus de pestilentia*, worin er vor allen Dingen den "documenta magnae excellentiae viri ANTONII CERMISONII" folgte. In den beiden Werken jenes bekannten italienischen Arztes († 1441), die mir vorliegen (*Consilia* und *De urinis*), finde ich keine Parallelstellen zu MATHIAS. Nun gibt GRÄSSE, *Trésor de livres rares*, II (1861) S. 105 folgendes an: "Le *Catal. Libri* 1859 N° 590 fait mention de *Recepte contra la pestilentia*, s.l. ni d., in-4°, compil. par le même auteur" (ANT. CERMISONE). Darnach scheint ANTONIO eine Rezeptensammlung wider die Pest verfasst zu haben, welche zu Ende des XV Jahrhunderts ins Italienische übersetzt und gedruckt wurde. Welche Bibliothek besitzt das Werk, lateinisch oder italienisch, handschriftlich oder gedruckt? Hat jemand irgendwo über dasselbe geschrieben?

Krakau. ALEXANDER BIRKENMAJER.

Query no. 28.—*Georges Pachymeres.*

Toute personne connaissant l'existence d'un manuscrit (n'importe quelle œuvre) de GEORGES PACHYMÈRE dans une bibliothèque non encore cataloguée complètement rendrait service en en informant leR. P. LAURENT, directeur des *Echos d'Orient*, 9 rue Cem, a Kadi Köy (Istanbul).

Query no. 29.—*Theon d'Alexandrie.*

Prière de mentionner l'existence de manuscrits non encore catalogués de THÉON D'ALEXANDRIE, avec brève description si possible.

(*Louvain.*) ABBÉ A. ROME.

Query no. 30.—*Pappos d'Alexandrie.*

Prière de mentionner l'existence de manuscrits non encore catalogués de PAPPOS D'ALEXANDRIE, avec brève description si possible.

(*Louvain.*) ABBÉ A. ROME.

Question no. 31.—*Johann Tobias Mayer comme géomètre.*

Dans le T. III (pp. 555-56) de ses *Vorlesungen über Geschichte der Mathematik* M. CANTOR a fait connaître une dispute qui eut lieu entre J. T. MAYER, qui a une place distinguée dans l'histoire de l'astronomie et un professeur de géométrie pratique C. H. WILKE. Mais, pressé qu'il était par le nombre extraordinaire des noms et des faits, il a laissé dans son récit bon nombre de lacunes (et la même chose peut se répéter au sujet de l'article, d'ailleurs excellent, que S. GÜNTHER a consacré à MAYER dans l'*Allgemeine deutsche Biographie*) qu'il serait très intéressant de combler. Pour m'instruire à ce sujet, j'ai essayé de prendre connaissance directe du volume, publié par MAYER lorsqu'il n'avait que dix-huit ans: *Neue und allgemeine Art, alle Aufgaben aus der Geometrie vermittelst die geometrischen Linien leicht aufzulösen* (Esslingen, 1741); mais malgré le précieux concours de M. NEUGEBAUER, que je remercie de tout mon cœur, je n'ai pu y aboutir. Les questions qui se présentent à mon esprit sont les suivantes : Les droits de priorité que voulait faire valoir MAYER étaient-ils basés sur le volume que je viens de citer, ou bien sur quelque autre publication, ou sur ce qu'il avait exposé dans ses leçons, ou enfin sur le mémoire *De transmutatione figurarum rectilinearum in triangula* présenté (c'est CANTOR qui le dit) à la Société de Göttingen, mais qui n'a jamais été imprimé.

Ces questions et d'autres analogues qu'il est facile d'imaginer, trouveraient réponse satisfaisante dans une monographie sur MAYER géomètre, où l'on pourrait apprendre quels sont les perfectionnements qu'il sut apporter à la science de l'étendue, à l'époque où EULER dominait comme un souverain sur l'univers mathématique, soit par ses travaux (non exclu le mémoire inédit que nous venons de citer et dont l'original doit se trouver dans les archives de la Société de Göttingen), soit par son enseignement oral.

GINO LORIA.

Question no. 32.—*Les miroirs ardents d'Archimède.*

Parmi les récits impressionants des anciens sur l'habileté extraordinaire du grand Syracusain dans la construction d'instruments compliqués, le plus étonnant est sans doute celui qui se rapporte aux miroirs avec lesquels il aurait brûlé la flotte romaine pendant le siège de Syracuse au cours de la seconde guerre de Rome avec Carthage. Sur la possibilité de cet exploit, les doutes se présentent en foule à l'esprit. Avant tout, l'état enfantin de l'optique et de la technique trois siècles avant J. C. Ensuite l'insuccès des essais que l'on fit pour reproduire un tel résultat, même à une échelle réduite. Enfin le silence sur cet événement chez les historiens les plus réputés. Cela posé, une recherche qui s'impose

est l'examen approfondi des sources auxquelles on a puisé ce récit, avec le double but, ou de prouver que le génie d'ARCHIMÈDE est arrivé à une hauteur que les modernes n'ont pas pu atteindre, ou bien d'effacer de l'histoire de la science une page probablement digne de porter la signature de HOFFMANN. Comme point de départ, on peut utilement choisir les pages 39-41 de *Quaestiones Archimedeae* de J. L. HEIBERG (Hauniae, 1879), — faute d'espace, je regrette de ne pouvoir les reproduire ici *in-extenso* — où l'on apprend que le célèbre hélléniste nourissait des doutes sur la vérité de ce récit ; malheureusement la faible diffusion qu'obtint cette Dissertation de doctorat (n'oublions pas que l'auteur était alors au début de sa carrière) eut pour conséquence que les miroirs ardents ont continué à paraître dans la collection des inventions d'ARCHIMÈDE historiquement pouvées.

GINO LORIA.

Question no. 33.—*Introduction of cacti and other Cactaceae into Europe.*

When travelling around the Mediterranean Sea one cannot help admiring in almost every country luxuriant cacti. These plants are so well adapted to the Mediterranean climate and have developed so abundantly that it requires some effort to realize that they did not really originate in those countries, but are only emigrants, and relatively late ones at that. Indeed as far as I was able to ascertain the *Cactaceae* are all of American origin, and if so they could not have been introduced before 1492.

This suggests the following questions : When, by whom and how were those plants introduced into the Mediterranean world ? When were they first mentioned ; and when and where is their introduction and their European cultivation first mentioned ? Are no *Cactaceae* whatever of European origin ?

There is no mention of *Cactaceae* in the classical work of ALPHONSE DE CANDOLLE : Origin of cultivated plants (1883). The elaborate monograph of N. L. BRITTON and J. N. ROSE : The *Cactaceae*. Descriptions and illustrations of plants of the *Cactus* family (4 quarto vols., Carnegie Institution, Washington, D.C., 1919-23) does not contain geographical and historical summaries, but abundant geographical and historical data are scattered *passim*. The answer to my queries might possibly be extracted from a patient analysis of these four volumes, or at any rate the beginning of an answer and the means of developing it.

GEORGE SARTON.

Query no. 34.—*The Guild of Physicians, Apothecaries and Merchants in Florence at the beginning of the 14th Century, and at the close of the 15th Century.*

The publication of PIERO GIACOSA's " Magistri Salernitani " (edited by FRATELLI BOCCA) has made available the Latin text of the Revised Constitution of 1313-1316. It is a lengthy document, wherein is portrayed, with most exact minutiae, the seemingly close surveillance of the practice of pharmacy in Florence. Numerous regulations are provided and an endless catalog of fines by which the offender will be punished, should he prove remiss in complying with the rules set forth in the Constitution. The several Guild officers and their duties are described in detail.

The Diary of LUCCA LANDUCCI has also been made available, viz., in English translation by ALICE DE ROSEN JERVIS. It covers the period from 1450 to 1516, and seems to record every event, unimportant as well as important, that occurred on the Piazza de' Signori on which the boutique faced. However, there is but one reference to the doings of the Guild. LANDUCCI informs us that the masters of the Guild met to fix the price of wax candles. Judging by the absence of references of professional import, it would seem that the organization played but an insignificant role in the life of its members.

This inference may be unwarranted for the author of the Diary appears to have been either ignorant of the discovery of the new continent by COLUMBUS and of the discovery of an all-water route to the East Indies by DA GAMA, or indifferent to these remarkable achievements, though they had a vital effect on the drug trade.

Is any one sufficiently acquainted with the history of guilds in general, and with that of the particular Florence Guild under consideration, to throw light on what appears, to the uninitiated at least, a situation in need of explanation?

Madison, Wisc. EDWARD KREMERS.

Query No. 35.—***Earliest diagrams showing the axis of a comet tail coinciding with the radius vector.*** (Pl. I and II).

Statement of GEMMA FRISIUS (1): " Hoc enim iam inde ab anno .1532. a nobis iugiter obseruatum est, quod cauda siue coma semper rectissima proiiciatur in contrariam Soli partem. Quod etiam diligenter a PETRO APIANO annotatum est, & primo in lucem emissum. Quanquam etiam verisimile est vetustissimos quosdam idem sciuisse ac obseruasse."

The woodcut on the title page (2) of *Practica auff dz .1532. Jar* illustrates

(1) *De radio astronomico & geometrico liber*, Antwerp 1545, 33 recto.

(2) F. VAN ORTROY, Bibliographie de l'œuvre de PIERRE APIAN, No. 17. *Le bibliographe moderne*, 5, 110, 1901. — See also K. SCHOTTENLOHER, *Die Landshuter Buchdrucker der 16. Jahrhunderts.* Mit einem Anhang: Die Apianusdruckerei in Ingolstadt. Mainz 1930, p. 54.

P. APIAN's observations made in August, 1531 (HALLEY's comet). The woodcut on the title page (3) of *Ein kurtzer bericht d'Obseruation vnnd vrtels / des Jüngst erschinnen Cometen / jm weinmon vñ wintermon dises XXXII. Jars* represents P. APIAN's observations of the comet 1532 (dated observations : Oct. 2 and 3, in Virgo; Oct. 14, crossing the ecliptic and entering Libra; Oct. 19 and 31, and Nov. 1, in Libra; Nov. 8, in Scorpio; the radius vector is totally or partially absent in the case of the undated positions at the end and in the middle of Libra). Are these the earliest diagrams showing a comet tail directed in prolongation of the radius vector?

General statements concerning the direction of comet tails are not lacking in Antiquity and the Middle Ages; see, e.g., GROSSETESTE's *De cometis* (" non semper protenditur cauda comete in oppositum solis ") in *Isis*, 19, 22, 1933.

APIAN's contribution was thus characterized by ARAGO (4) : " Le curieux renseignement, extrait par M. ÉD. BIOT (5) des Annales de la Chine, devra, sans contredit, prendre désormais sa place dans l'histoire de l'Astronomie; mais il n'effacera pas, toutefois, l'observation d'APIAN. Cet astronome, en effet, ne se contenta pas de dire que la queue d'une comète située à l'orient du soleil est invariablement dirigée vers l'orient à partir du noyau, et que la queue d'une comète occidentale se porte à l'occident; il annonça que l'axe de la queue prolongé, passe par le soleil." A. POGO.

Query No. 36.—*Pietro Ranzano* (d. 1492).

QUETIF and ECHARD, *Scriptores ordinis praedicatorum*, 1719-1721, I, 876, ascribed to PETER RANSANUS, or RAZZANA of Palermo (RANZANO, according to CHEVALIER, *Répertoire des Sources Historiques du Moyen Age*, 1907, II, 3880) " volumina iv grandiora de omnibus scientiis tam practicis quam speculationis, de geographia etiam et historia stylo suavi." Other authors, like TIRABOSCHI and MONGITORE, ascribe to RANZANO only historical works, a geography, and some orations and poems. The only works by him which I have been able to find in print are historical.

(3) VAN ORTROY, *loc. cit.*, No. 97, p. 303. See also SCHOTTENLOHER, *loc. cit.*, p. 76. APIAN observed the comet from Sept. 25 until Nov. 20, i.e., during Weinmond, Herbstmond, and Wintermond.

(4) *Comptes rendus*, 16, 751-52, 1843.

(5) *Ibid.*, La description d'une comète observée le 22 mars et jours suivants de l'an 837 est terminée par ces mots : « *En général quand une comète (littéralement un balai) paraît le matin, alors elle est dirigée vers l'occident; quand elle paraît le soir, elle est dirigée vers l'orient. C'est une règle constante* ». Cf. *Connaissance des temps* pour l'an 1846 (Paris 1843), Additions, p. 79.

Practica auff dz .1532. Jar

Zů Eeren den Durchleuchtigen Hochgebornen Fürsten vnnd H. H. Herrn Wilhelmen vnd Herrn Ludwigen Pfaltzgrauen bey Rheyn Hertzogen in Obern vnd Nidern Bayern ꝛc. Gebruder / Durch Petrum Apianum der löblichen Hohenschůl zů Ingelstat Mathematicum / nach rechter kunst vnd art der Astronomei Practiciert.

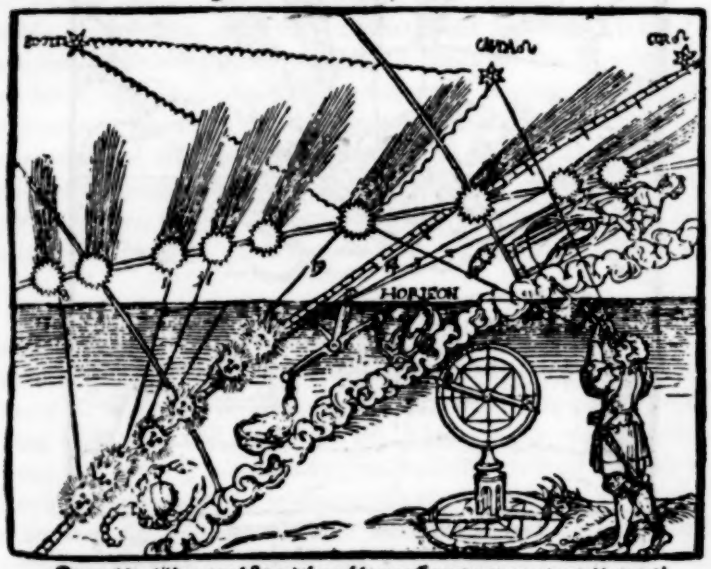
Auch wirdt nachuolgend von dem nechst erschinen Cometen / wie vnnd in was gestalt in gemelter Apianus obseruiert hat: vñ welhe bös: her / dero vil sind / in jrem schreiben jrrig gefunden / bewerlich angezaigt.

Roma cave tibi portendit mala signa Cometes
Crinitus, clades. Martis & arma fere
Roma cave tibi portendat modo summa
Pontifices. sydus fert tibi triste nimis
Gedruckt in Landßhůt durch
Georgium Apianum.

Pl. I. — Petrus Apianus. *Practica auff dz .1532. Jar.* Landshut, Georgius Apianus, (1531). Woodcut : Comet 1531, in August (Halley's comet). (F. Van Ortroy, No. 17; reduced photostat reproduction).

Ein kurtzer bericht d Obſer

uation vnnd vrtels / des Jüngſt erſchinnen Cometen/jm weinmon vñ wintermon diſes XXXII. Jars Zů Ehrn demñ Durchleüchtigen/ Hochgebornen/Fürſten vnd Herrn/Herrn Wilhelm/Pfaltzgraue bey Rhein/ Hertzo: jn Obern vnd Nidern Bayrn ꝛc. gantz Deutſcher Nation/vnd den liebhabern der Aſtronomiſchen künſt zů Nutz/Durch Petrum Apianum von Leyſznigk/ der Hohenſchuell Inglſtat Aſtronomum/ auffs fleyſſigiſt wargenommen vnnd practicirt.



Die weil bis jtz dem / nechſt vor diſen erſchinnen Cometen/ vormals nie thainer/ nach ſeinem lauff oder ſtandt obſeruirt oder abgeſchrieben iſt worde/ vnd gar vill nutzbarthen/ vnd vrſach jrer entzündung dar aus mag ergrundt werde/ Vnd die weill auch etlicher maſſen gleich ein widerwertiger lauff darinne geſpört wirdt/ hab ich den ſelben jtz vnz den verſtendigen vnnd achtnemenden diſer kunſt hienach geſetzt.

Pl. II. — Petrus Apianus. *Ein kurtzer bericht d'Obseruation* etc. Ingolstadt, (Petrus Apianus), (1532). Woodcut : Comet 1532, Oct. 2 to Nov. 8. (F. Van Ortroy, No. 97; reduced photostat reproduction).

Is there any other trace of a work by him on all sciences, practical as well as speculative, than the passage in QUETIF and ECHARD? RANZANO was born at Palermo about 1428, became a Dominican about 1444, and was made Bishop of Lucera in 1476. He died in 1492.

(New York City.) LYNN THORNDIKE.

Query No. 37.—*Magnal, fl. 1709 and the use of dyes to detect physiological functions.*

In seinem "Versuch einer allgemeinen physiologischen Chemie," Braunschweig 1844-51, S. 798 schreibt G. J. MULDER: "MAGNAL hat im Jahre 1709 zuerst das schon früher in der Anatomie des Menschen gebräuchliche Mittel angewandt, durch Farbstoffe den Weg, welchen die durch die Wurzel aufgesogene Flüssigkeit nimmt, sichtbar zu machen."

Wer war MAGNAL, und war er der erste der Farbstoffe durch Pflanzen aufsaugen liess, um den Saftstrom in ihnen zu verfolgen?

(Heidelberg.) EDUARD FÄRBER.

II. MISCELLANEA.

Rufinus.—I find that in my article "Rufinus: A Forgotten Botanist of the Thirteenth Century," *Isis* XVIII, July, 1932, at page 64, the name of BENEDETTO RINIO is incorrectly spelled Rivio, both in the text and the citation of ETTORE DE TONI's papers. I cannot find any authority for the spelling Rivio. DE TONI, FISCHER, and VALENTINELLI in describing the manuscript at the Library of St. Mark's, Venice L. VI, LIX (Valentinelli XIII, 10), give the spelling as RINIO in Italian or RINIUS in Latin. LYNN THORNDIKE.

Geschichte der Technik in Russland.—Auf Anregung von GORKI entsteht ein vielbändiges Sammelwerk über die Geschichte der grossen Fabriken und Industriewerke der Union. Die Publikation soll nicht nur historisch, sondern auch künstlerisch wertvoll ausfallen, und unter Mitarbeit der bedeutendsten Schriftsteller des Landes die Wirksamkeit des "unsichtbaren Helden", des Massenmenschen zeigen.

F. M. FELDHAUS.

Trevithick centenary commemoration.—Extracts from an appeal addressed by the Institution of Civil Engineers, Great George St., London, S. W. 1, December, 1932.

"Among those who contributed to Great Britain's pre-eminence in engineering in the first half of the 19th century none is more worthy to be held in remembrance than the Cornishman, RICHARD TREVITHICK.

Born in 1771, before the 18th century had closed he had enlarged to an incalculable extent the scope of steam power by the invention of the high pressure engine. Before his time, all engines worked on the low pressure or atmospheric principle invented by THOMAS NEWCOMEN and greatly modified by JAMES WATT. This principle involved the use of a condenser and a steam pressure rarely exceeding four or five pounds per square inch. TREVITHICK with surpassing boldness raised the pressure as much as twentyfold, and dispensed with the condenser; by 1802 he had produced quite small portable engines in place of the huge fixed engines of his predecessors, for the same power.

For some years, men had been attempting road transport by steam power, but as long as low pressures were used this was not practicable. TREVITHICK's engine and high pressure boiler opened the way, and it was he who designed the first practicable steam road carriage and the first railway locomotive. His road carriage made its first trip on Christmas Eve, 1801, and two years later he ran his first rail locomotive on the Pen-y-daren tramway in South Wales. He applied his engine to such varied purposes as pumping in mines, blowing furnaces, iron manufacture, dredging, propelling vessels, and thrashing corn. Nor does this exhaust the tale of his inventions in these and other fields.

After a life full of romance and vicissitude he died in April, 1833, at Dartford, Kent, and was buried there. For half a century his name was overshadowed by those of men whose careers had been more fortunate, but he is now universally acclaimed as the true Father of the Steam Locomotive."

The centenary of his death will be celebrated in April 1933 by the following proceedings:

"The erection of a memorial at his birthplace. Also one at Pen-y-daren and one near Euston Road where he ran locomotives. The holding of Memorial Services in Westminster Abbey and at Dartford Parish Church. An exhibition connected with his life and work. The delivery of a Memorial Lecture. The publication of a Memorial Volume."

"Accordingly a Fund has been opened to which the Committee earnestly invites subscriptions from those in sympathy with its objects. Messrs. COUTTS & Co., 440, Strand, London, W. C. 2, have undertaken to act as treasurers of the fund. Cheques, drafts, and P. O.'s should be made payable to the bankers and crossed 'Trevithick Centenary Fund.'"

Luftfahrtmuseum der Stadt Berlin.—Im November 1932 wurde in Berlin ein grosses Luftfahrtmuseum eröffnet. Es sind etwa 40 Originalflugzeuge ausgestellt. Das älteste ist eine WRIGHT-Maschine von 1908

Neben vielen Motoren, Propellern usw. sieht man auch grosse Originalstücke von ZEPPELIN-Luftschiffen und zahlreiche Modelle und Bilder. Unter Mitarbeit von F. M. FELDHAUS wurde eine geschichtliche Abteilung eingerichtet, in der photographische Vergrösserungen alter Bilder, wie auch Original-Bilder und Original-Schriftstücke zu sehen sind. Die Reihe der Bilder beginnt mit den alten Sagen : Ikarus-Sage, Alexander-Sage usw. Zum erstenmal gezeigt wird die photographische Vergrösserung aus einem Gemälde von PIETER VAN BRUEGEL D. ÄLTEREN (Bauern. Bruegel). Dieses Gemälde hängt in der Gallerie zu Wien und zeigt viele Kinder-Spiele. Ein Knabe lässt einen Luftkreisel aufsteigen, den er durch Abziehen einer Schnur in Drehung versetzt. Hier haben wir also, etwa um das Jahr 1650, den Propeller.

F. M. FELDHAUS.

History of Pharmacy.—The organization of apothecaries into guilds, and the later reorganization of these guilds, on the one hand into colleges and on the other into societies, constitutes a chapter of the history of pharmacy that is none too well understood for the simple reason that the early histories of individual organizations have not been written in more than a few instances.

This defect has been remedied so far as the organization of apothecaries of Nuernberg is concerned. Two recent " Veroeffentlichungen " of the Gesellschaft fuer Geschichte der Pharmacie are devoted to this subject.

1) " Festschrift vom Apothekerverein Nuernberg und Umgebung zur Erinnerung an die vor 300 Jahren erfolgte Gruendung des ' Collegium Pharmaceuticum Norimbergense.' " It is a brochure of 70 pages with numerous illustrations of portraits, coats of arms, certificates, seals, old apothecary buildings, etc.

2) " Versuch einer Geschichte des Apothekenwesens in der freyen Reichsstadt Nuernberg." This brochure of 60 pages is an exact reprint of the original publication of 1792 in commemoration of the two hundreth anniversary of the Collegium Medicum of Nuernberg. Paper and type are imitations of the original.

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The University of Basel, which not long ago established a department of pharmaceutical history in connection with its Pharmaceutical Institute, has issued a second publication. The earlier one is an illustrated volume describing the admirable historical collection of the Institute brought together by Dr. J. A. HAEFLINGER, the incumbent of the chair of History of Pharmacy. This second publication constitutes a brochure of 190 pages devoted to " Die Apotheker und Apotheken Basels " by the same author.

It is a reprint of the *Basler Zeitschrift fuer Geschichte und Altertumskunde*, Bd. XXXI (1932) pp. 278 to 468. It is illustrated and provided with an index.

(*University of Wisconsin.*) EDWARD KREMERS.

Lectures on the History of Science in Syria and Palestine.—In the course of his travels in Western Asia, Dr. GEORGE SARTON delivered two lectures in English on " Mediaeval science and culture, with special reference to the Arabic writings " before the American University of Beirūt on Feb. 26 and March 4, 1932. Dr. SARTON prepared an Arabic summary of these lectures which was published in the *Kulliyah* of Beirūt (vol. 18, 270-74, 366-73, 1932), and also in pamphlet form (14 p., Beirūt, 1932).

He delivered a third lecture on the same subject in Beirūt on March 16, under the auspices of the Islamic Society Al-maqāšid al-khairiyah al-islāmiyah. This lecture was introduced in Arabic but delivered in French, and it was gradually translated into Arabic by Professor 'ABDALLĀH MASHNŪQ.

While in Jerusalem he spoke before the Hebrew University on April 4 and again on the same day more informally at the residence of Professor F. S. BODENHEIMER, the well known historian of entomology (1), in the House of Ussischkin. Both lectures were delivered in English; the first was introduced in Hebrew by Chancellor JUDAH LEON MAGNES; the second was introduced in German by Prof. BODENHEIMER and was followed by a discussion in German.

These lectures were probably the first of their kind in the Near East.

Alma mater Dorpatensis 1632-1932.—Founded by GUSTAVUS ADOLPHUS on one of the battle fields of the Thirty Years War, viz. that of Nuernberg, reorganized by ALEXANDER I, Czar of Russia, in 1802, the University of Dorpat (Yuriev, now Tartu), was essentially a German institution of learning until its Russification in 1894. Since the close of the World War it has become the national university of Estonia. The battles between Swedish and Russian political domination on the one hand, and between German, Russian and Estonian intellectual influences on the other hand are all reflected in the three centuries of its history which was not always continuous.

The " Revalsche Zeitung " for June 29th, 1932, contains a number of essays on as many phases of university life and activities. One of

(1) Author of *Materialien zur Geschichte der Entomologie bis* LINNÉ (Berlin, 1928-29; *Isis*, 13, 388-92; 14, 454-56).

these deals with the Physico-Mathematical Faculty. As Professor of Chemistry, CARL SCHMIDT taught from 1846 until about the nineties. Here also taught for a time, WILHELM OSTWALD, one of the founders of modern physical chemistry, who died recently. Of the Medical Faculty, KOBERT, as Professor of Pharmacology and of the History of Medicine, is well known to historical students. His " Historische Studien aus dem Pharmacologischen Institut der Universitaet Dorpat " are constantly referred to by students of the history of medicine and pharmacy. Here also taught DRAGENDORFF as Professor of Pharmacy, known the world over through his " Analyse von Pflanzen und Pflanzentheilen," the standard of a previous generation of phytochemists.

Many other representatives of the several sciences, indeed too many to be here enumerated, were at one time or another associated with this interesting seat of learning on the Baltic.

(Madison, Wisc.) E. KREMERS.

III. PERSONALIA.

John Stephenson (1871-1933).—We regret to announce the death which occurred in London on Feb. 2, 1933 of Lieut. Col. J. STEPHENSON, C.I.E., F.R.S. He was born in Padiham, Lancashire, in 1871; was a member of the Indian Medical Service from 1895 to 1920; then a lecturer in zoology at the University of Edinburgh; finally an unofficial worker in the Natural History Museum, British Museum, London. His main scientific publications are the volume on oligochaetes in „The fauna of British India " (1923) and the monograph on Oligochaeta (Oxford, 1930). He had a deep interest in the history of science and had been a member of the H.S.S. for many years. He published various notes in *Isis* and two important studies : (1) The classification of the sciences according to NASIRUDDIN TUSI (vol. 5, 329-38, 1923); (2) The zoological section of the *Nuzhatu-l-qulūb* (vol. 11, 285-315, 1928). He edited the Persian text and an English version of the zoological section of the *Nuzhatu-l-qulūb* (London, R.A.S., 1928; *Isis*, 13, 435). A more detailed obituary by J. H. ASHWORTH appeared in *Nature* (vol. 131, 193, 1933). We beg to express our deep sympathy to Mrs. STEPHENSON.

G. S.

Dr. DAVID RIESMAN has been elected professor of the history of medicine in the University of Pennsylvania, filling a newly established chair. *Science*, 77, p. 279, 1933.

Reviews

Alfarabi.—***Catálogo de las Ciencias.*** Edición y Traducción Castellana por ANGEL GONZÁLEZ PALENCIA, Catedrático de Literatura arábigo-española en la Universidad. Publicaciones de la Facultad de filosofía y letras. Universidad de Madrid, Volumen II. Madrid: Imprenta de ESTANISLAO MAESTRE, 1932. Pp. XX+176+84.

In the long history of the penetration of Greek ideas on philosophy and science into the civilization of Islam the name of AL-FĀRĀBĪ has an honoured place as one of the most successful breakers of the road. He was a Turk from Fārāb beyond the Oxus (see, however, LE STRANGE, Lands of the Eastern Caliphate, p. 485) and died at Damascus in 339/950. His fame has been much obscured by that of IBN SĪNĀ who died some 90 years later. Yet IBN SĪNĀ himself acknowledged him his master in ARISTOTLE. A tractate of his appeared at Venice in Latin translation as early as 1484 and this very book now published in Arabic, Spanish and Latin (two Latin versions) appeared in Latin at Paris in 1638, edited by a wandering Scottish theologian and canonist GUILIELMUS CAMERARIUS (WILLIAM CHALMERS, S.J.), who signed himself "SCOTUS FINTRAEUS." I give this detail because I do not know who he was and he seems to be the one scholar whom Fintry, a little village in the Fintry hills north of Glasgow, has produced. Fārāb has other scholars to its credit but has given its name peculiarly to this philosopher.

AL-FĀRĀBĪ, therefore, has long been known to the West in Arabic, Hebrew and Latin. In more modern times CASIRI (1760) dealt with him in his Catalogue of the Escorial Mss.; SCHMÖLDERS published two tractates in 1836; STEINSCHNEIDER gave an elaborate life and bibliography in 1869; DIETERICI published a series of tractates with translations from 1890 on; there are other translations and studies by BAUR (1903), WIEDEMAN (1907), BOUYGES and HORTEN. For a general statement on AL-FĀRĀBĪ see the *Introduction to the History of Science*, I, pp. 628 f. and by Index and for the manuscripts see BROCKELMANN, *Geschichte*, I, pp. 210 ff. He even returned to the East in a reprint—with additions—of DIETERICI's 1890 volume (Cairo 1907). Since then the East has

become fully awake to the glories of its philosophical past and is searching out its own Mss. and printing from them. Thus it has come about that the present European edition of the *Iḥṣā al-'ulūm* is really the third. The first appeared in 1921 in an Arabic periodical published at Ṣaida in Syria, printed from a Ms. found at Nejef in Iraq, the residing-place of its editor. The second appeared in Cairo 1931, edited by UTHMAN MUHAMMAD AMIN from a photograph, of unknown source, in the Royal Library, Cairo. Both of those editions have introductory matter showing knowledge not only of eastern but also of western sources.

The present edition is from a Maghrabi Ms. in the Escorial, collated with and supplemented from the Cairo edition. From the three Mss. of such widely spread provenance, lying behind the three editions, it should be possible to reach a definitive text. Professor GONZÁLEZ PALENCIA has added a Spanish translation and also two of the old Latin translations of the tractate. One of these, unpublished before, and now printed from a Ms. in the Bibliothèque Nationale, was made in Toledo by GERARD OF CREMONA from the Arabic. The other is reprinted from the Paris edition of 1638, referred to above. In that edition there are two tractates by AL-FĀRĀBĪ : the *Iḥṣā* from a Ms. then in the Library of S. Aubin at Angers (where now?) and a reprint, from a Venice edition, of the tractate *De Intellectu et Intellecto*. This second was printed in Arabic but from an incomplete Ms. by DIETERICI in 1890.

It may be said, then, that this outline-encyclopedia, a compendium of scholastic knowledge in 53 pages of Arabic, is now quite fully before us. But what is it in itself? It is an exceedingly exact, concise and throughout acute statement of AL-FĀRĀBĪ's positions on the sciences of languages, logic, mathematics (arithmetic, geometry, optics, astronomy, music, engineering), physics and metaphysics in the Aristotelian senses, the state, law and scholastic theology with the relation of religious authority and reason. In its keen brevity it brings home to us the pity that the longer works of AL-FĀRĀBĪ seem all to have perished. This, apparently, was due to two causes—the greater popularity of IBN SĪNĀ and the passion of the East for compends.

The above review should be read along with Dr. SARTON's review of the *second* edition of the Arabic text (Cairo 1931) in *Isis*, 19, 201-03. As will be seen, this third and most valuable edition meets Dr. SARTON's expectations in that review. D. B. MACDONALD.

al-Bīrūnī.—*Das Vorwort zur Drogenkunde des Bīrūnī*. Eingeleitet, übersetzt und erläutert von MAX MEYERHOF. 52+18 p. (*Quellen und Studien zur Geschichte der Naturwissenschaften und der Medizin;* hrsg. vom Institut für Geschichte der Medizin und der Natur-

wissenschaften in Berlin. Band 3, Heft 3). Berlin, SPRINGER, 1932 (RM. 7.80).

The pharmacopoeia of AL-BĪRŪNĪ, *Kitāb aṣ-ṣaidana fi-ṭ-ṭibb*, was thus far hardly known though IBN ABĪ UṢAIBI'A had briefly described it. H. BEVERIDGE spoke of a Persian MS. of it (B.M., Or. 5849) as early as 1902 (*J.R.A.S.*, 333-5), and FR. KRENKOW has recently discovered another Persian Ms. in India. The first Arabic Ms. was discovered only in 1930 in a government library of Brussa. It originated from Kayseri (Caesarea in Cappadocia). The Brussa Ms. was copied in 1279 A.D. by a well-known scholar, ABŪ ISḤĀQ IBRĀHĪM IBN MUḤAMMAD AL-TABRĪZĪ AL-GHAḌANFAR (born c. 1232 A.D.) upon the basis of another Ms.—partly excellent partly very bad, the good part of it being written in 1154 A.D. by the astronomer ẒAHĪR AL-ḤAQQ ABŪ-L-MAḤĀMID MUḤAMMAD AL-GHAZNAWĪ—that is, he of Ghazna, the very city where AL-BĪRŪNĪ spent many years and which was probably his deathplace in 1048; the bad part being hastily scribbled by another hand. In fact the task of the copyists was exceedingly difficult because it would seem that no fair copy of that work was ever made by AL-BĪRŪNĪ himself. It would seem that a draft containing information on the main drugs was prepared by AL-BĪRŪNĪ's assistant, one ABŪ ḤĀMID AḤMAD IBN MUḤAMMAD AL-NAHSHA'Ī, and that AL-BĪRŪNĪ added between the lines and in the margins what he knew of the names, and places of origin, and of the rarer drugs.

The single Arabic Ms. of Brussa is incomplete (the letters rā, bā, jīm, qāf are altogether missing) to the extent that it would be impossible to base a scientific edition upon it, even with the help of the two Persian Mss., but another Arabic Ms. may turn up later on. This would be very desirable because the text of this pharmacopoeia seems to be far superior to the much larger work of IBN AL-BAIṬĀR or AL-GHĀFIQĪ (see *Isis*, 20, 454). IBN AL-BAIṬĀR quotes about 150 authors, almost all of them physicians; while AL-BĪRŪNĪ quotes only a hundred, including not only physicians, but other scientists, philosophers, grammarians and poets. By way of illustration, here are the men mentioned in the letter alif (p. 19) :

" Von Griechen zitiert B. den ARISTOTELES, und zwar kritischer als die meisten islamischen Gelehrten; denn er sagt ' sein Tierbuch,' aber ' das ihm zugeschriebene Steinbuch.' Er zitiert ferner die Ärzte DIOSKURIDES, GALENOS, OREIBASIOS, AETIOS und PAULOS VON AIGINA. Ferner das Alte Testament, das damals wohl noch vorwiegend in der syrischen Version der Septuaginta in Vorder- und Zentralasien verbreitet war, und eine Reihe von bekannten syrischen Ärzten und Übersetzern griechischer naturwissenschaftlich-medizinischer Werke. So den Juden MĀSARJAWAIH, die Christen SAHĀRBOKHT, YUḤANNĀ B. MĀSAWAIH, SALMAWAIH, ḤUNAIN B. ISḤĀQ und seinen Neffen ḤUBAISH, den QUSṬĀ B. LŪQĀ, den

syrischen Erzbischof ISHO'BOKHT und einen JIBRĀ'ĪL, der wahrscheinlich mit dem dritten Mitglied der berühmten Ärztefamilie der BOKHTISHŌ' identisch ist, welche vom 2./8. bis zum 5./11. Jahrhundert in Mesopotamien bedeutende Leibärzte und Beamte des Kalifenhofes zu Baghdad hervorgebracht hat. Von arabisch schreibenden Ärzten werden von B. genannt: am häufigsten AR-RĀZĪ (RHAZES), dann 'ALĪ B. RABBAN AṬ-ṬABARĪ, und danach die christlichen Ärzte ABŪ JURAIJ, IBN AL-BIṬRĪQ, MASĪḤ B. ḤAKAM, 'ISĀ B. MĀSĀ, ABŪ 'UTHMĀN AD-DIMASHQĪ und SĀBŪR B. SAHL. Von Philosophen zitiert B. ausser ARISTOTELES und AL-KINDĪ den AL-FĀRĀBĪ, IBN AL-KHAMMĀR, ABŪ L-ḤASAN AL-'ĀMIRĪ und MISKAWAIH. Dagegen führt er die Werke seines grössten Zeitgenossen IBN SĪNĀ (AVICENNA) nicht an. Vielleicht besass er noch keine Abschriften; aber es kann auch sein, dass ihn die obenerwähnte Polemik veranlasst hat, die Schriften seines Gegners zu ignorieren; denn einen anderen Zeitgenossen, den persischen Arzt IBN MANDAWAIH, führt er mehrfach an."

AL-BĪRŪNĪ was not a physician and he generally abstains from proferring medical information and restricts himself to pharmacognosy. He gives many foreign names of each drug, not only the Greek, Syriac, Persian, and Indian names which are almost always quoted, but also sometimes the names in Hebrew and in various languages of central and southern Asia. The Arabic names are explained and discussed. A number of the works quoted by him cannot be identified.

If an edition of the body of this work is still out of the question, this impossibility does not apply fortunately to the very interesting introduction, which is here edited in extenso, translated into German and annotated.

The following is a brief analysis of it. Introduction. Definition of pharmacy and druggist and place of pharmacy in the medical field.

Chapter I. Philological discussions. The Indian-Persian-Turkish letter chīm often corresponds to the Arabic ṣād.

Chapter II. Different Arabic names for drugs in general. Distinctions between foodstuffs, drugs, and poisons. Account of a class of Hindu physicians dealing mainly with poisons.

Chapter III. Succedanea.

"Gegen Ende dieses Kapitels macht B. einige Bemerkungen, welche von Bedeutung für die Geschichte der Wissenschaften sind. Der grosse Gelehrte, der als Vertreter der arabisch-persischen Wissenschaften par excellence anerkannt ist, drückt dort seine Meinung von der Überlegenheit der Griechen rückhaltlos aus und spricht den orientalischen Völkern mit Ausnahme der Inder die 'primäre' Neigung zu den Wissenschaften ab. Zugleich erklärt er, warum die Wissenschaften der Inder so wenig nach Westen hin gewirkt haben: es ist die Verschiedenheit der wissenschaftlichen Grundlagen, der Sitten und Gebräuche, besonders der religiösen Reinheitsgesetze, welche Indien von den westlichen Nachbarn abgeschnitten und einen wissenschaftlichen Austausch grösseren Stils unmöglich gemacht hat. B. spricht hier sogar besonders deutlich einen Gedanken aus, den

in neuerer Zeit vor allem C. H. BECKER verficht, nämlich, dass der Kulturkreis des Islams westlich orientiert ist." (p. 48).

Chapter IV. This chapter is of great value for the study of AL-BĪRŪNĪ's own personality because it sets forth his views with regard to Islām and the Arabic language. This work composed toward the end of his life shows that he had finally become an orthodox and pious Sunnite. As to Arabic it is according to him the only Islamic language lending itself to scientific purposes.

Chapter V. Also of great biographical interest. AL-BĪRŪNĪ explains the early awakening of his desire to study foreign languages. He met accidentally in Khwārizm some Byzantines, who knew the Greek names of many drugs. He deplores the awkwardness of the Arabic script for the reproduction of foreign names, and criticizes the introduction of Greek words into the Arabic language. He mentions dictionaries which were used in his time in Central Asia : one of them referred to *ten* languages but there were only bad and incomplete copies of it; on the other hand, the Nestorians used a Greek-Syriac-Arabic-Persian dictionary of which perfect MSS. were available. Moreover the Nestorians used special lexica for special works, e.g,. for PTOLEMY's tables of stars.

Finally, AL-BĪRŪNĪ's explains the alphabetic order of his book. This ordering was done by him almost in the modern way, and hence it is much easier to find items in his pharmacopoeia than in those of AL-GHĀFIQĪ, AL-IDRĪSĪ, IBN JAZLA or IBN AL-BAIṬĀR.

This analysis will suffice to indicate the importance of this new text. To conclude, I might still quote MEYERHOF's general appraisement of it (p. 14) :

" Das Vorwort zum Drogenbuche, im folgenden übersetzt, ist ohne jeden Zweifel von AL-BERŪNĪ allein geschrieben worden. Es trägt unverkennbar den Stempel seiner originellen Persönlichkeit, seiner Wissbegierde auf den verschiedensten Gebieten, seiner umfangreichen Kenntnisse und seiner Vorliebe für Abschweifungen in Nachbargebiete der behandelten Themata. Schon aus diesem kurzen Abschnitt kann man deutlich seine naturwissenschaftlichen, philologischen und historischen Neigungen klar erkennen; eine tief religiös-islamische Einstellung und grosse Bewunderung für den wissenschaftlichen Wert der arabischen Sprache kommen hier klarer zutage, als in B.'s bisher bekannten Schriften. Bemerkenswert ist die Abwesenheit polemischer Bemerkungen über frühere Autoren auf dem Gebiete der Pharmakologie; ich kenne sonst keinen Traktat über Arzneimittellehre in arabischer Sprache, der nicht mit abfälligen Bemerkungen über vorausgegangene Werke gleicher Art eingeleitet würde."

GEORGE SARTON.

Aḥmad ibn Muḥammad al-Ghāfiqī.—*The abridged version of " The book of simple drugs "* of AHMAD IBN MUHAMMAD AL-GHĀFIQĪ by

GREGORIUS ABU'L-FARAG (BARHEBRAEUS). Edited from the only two known manuscripts with an English translation, commentary and indices by M. MEYERHOF and G. P. SOBHY. (The Egyptian University, The Faculty of Medicine, Publication no. 4). 236 p. Cairo, 1932.

Muntakhab kitāb jāmi'a al-mufradāt li AḤMAD IBN MUḤAMMAD AL-GHĀFIQĪ al-mutawaffī naḥwa sanat 560 h. intakhabahu ABŪ-L-FARAJ GREGORIUS al-ma'rūf bi IBN AL-'IBRĪ al-mutawaffī fī sanat 684 h. nasharahu ma'a tarjamah inklīziyah wa shurūhāt al-duktūr MAX MEYERHOF wal-duktūr JŪRJĪ ṢUBḤĪ. Maṭba'at al-'ittimād bi Miṣr (no date, first part of the Arabic text, 56 p., 1 facsm.).

It had been known for some time that Dr. MEYERHOF and Dr. SOBHY (to whom we owe already so many contributions to the history of Arabic science) were engaged in the preparation of a critical edition of this work. For example, I had already been able to announce that edition in my *Introduction* (vol. 2, 424). Needless to say, the arrival of the first part of that great work gave us great pleasure.

The edition is arranged as follows. The Arabic text is printed separately with but few critical notes. Another volume contains the literal English translation, each item (that is, the account of each simple) being followed by a commentary giving synonyms in many oriental and European languages, the botanical identification, etymological and historical information. An introduction of 47 p. includes an interesting list of " authors of botanical and pharmacological treatises " : 5 Greeks, 1 Greek or Syriac (AHRUN AL-QISS) and 52 Muslims or Arabs, beginning with THIYĀDŪQ and extending down to the eighteenth century, then information on AL-GHĀFIQĪ and BARHEBRAEUS, on the manuscripts, the sources used, etc. For the botanical and philological notes Dr. MEYERHOF has availed himself not only of the classical literature on the subject, but also of two modern Egyptian publications : the scientific dictionary of Dr. MOHAMMAD SHARAF (Cairo, 1929 ; *Isis*, 11, 230) and the excellent Dictionnaire des noms des plantes of Dr. AHMED ISSA BEY (Cairo, 1930, *Isis*, 20, 586).

The little we know of the author AL-GHĀFIQĪ is almost exclusively derived from the 'Uyūn al-anbā' of IBN ABĪ UṢAIBI'A (1) whose account is translated as follows :

" He is ABŪ JA'FAR AHMAD B. MUHAMMAD B. AS-SAYYID AL-GHĀFIQĪ an excellent leader and a learned doctor who was counted among the prominent men of Andalusia. He was the most experienced of his contemporaries about the faculties, uses, properties and essential qualities of simple remedies, and in the knowledge

(1) *Introduction*, 2, 685.

of their names. His book on Simple Drugs is not equalled in excellence or in sense; he abridged the writings of DIOSCURIDES and the great GALENOS in succinct language yet (preserving nevertheless) their full meanings. After their text, he mentioned all that was new in the sayings of later scholars concerning simple drugs, and what everyone of them had collected and known afterwards ! thus his book became a collection of the sayings of those who excelled in (the knowledge of) simple drugs, and an encyclopedia to which one had to refer in case of necessity for verification. Books written by AL-GHĀFIQĪ; Book of Simple Drugs.' "

AL-GHĀFIQĪ originated probably from Ghāfiq near Cordova, and he died in 1264-5 (source of this date unknown). He should not be confused as I have unfortunately done (*Introduction*, 2, 424) with another AL-GHĀFIQĪ, called MUḤAMMAD IBN QASSŪM IBN ASLAM, who seems to have been a contemporary and perhaps a relative and who wrote a treatise entitled Kitāb al-murshid fī-l-kuḥl (Guide to ophthalmology).

AL-GHĀFIQĪ's treatise on drugs has long been lost, but it was known through more than 200 explicit quotations included in IBN AL-BAIṬĀR's famous work (2). MEYERHOF has now satisfied himself that IBN AL-BAIṬĀR's borrowings were even greater than we assumed of LECLERC's evidence ; that they were indeed of such a nature that the term " plagiarism " would be a better description of them. Says he (p. 33) :

" It is now certain *that* IBN AL-BAIṬĀR's *pharmacology is nothing more than* AL-GHĀFIQĪ's *book with some enlargements and commentaries.* This would be still more evident if we had the original book of the latter. Consequently, LECLERC's judgment (II, p. 225) on IBN AL-BAIṬAR that he was ' the greatest botanist in the Orient,' has to be revised. Indeed he was nothing more than a very diligent and learned compiler. IBN ABI USAIBI'A wrote moreover (vol. II, p. 133 line 14) that IBN AL-BAIṬĀR always took with him, on his voyages the ' Materia Medica ' of DIOSCURIDES and GALEN and the drugbook of AHMED AL-GHĀFIQĪ."

This is such a terrible accusation that I must confess I still hesitate to accept it at its full value. After all we have not AL-GHĀFIQĪ's original text. It is proved that IBN AL-BAIṬĀR used it extensively, but not that he copied the whole of it. Neither can the present publication, that is the Arabic abridgment of AL-GHĀFIQĪ's treatise by ABŪ-L-FARAJ (3) clinch MEYERHOF's argument. Leaving that controversy aside, this abridgment or selection (muntakhab) is valuable for it was done with care by a man of unusual intelligence. Says MEYERHOF (p. 37) :

" He left out from the Greek quotations many names which were useless to

(2) *Introduction*, 2, 663-4.
(3) *Introduction*, 2, 975-79.

Arabic physicians, and suppressed several passages concerning Spanish or Latin names of drugs of no interest to Eastern scholars. He also left out the numerous repetitions found in the carefully collected quotations of old authors. However BARHEBRAEUS, as he stated in his fore-word, did not altogether suppress the parts about the therapeutic action of the drugs, and, according to his own words, the book became more readable and very instructive."

The Arabic text now offered to us is based on two Mss.—one of which (Gotha) is very well written, but very late and poor; while the other, in the late Taimûr pasha's library, is excellent and very early: it is dated 1285 (ABŪ-L-FARAJ died only in 1286) and may have been copied from the author's own Ms.

The present instalment contains the descriptions of 116 simples and does not yet exhaust the letter alif (the first of the Arabic alphabet). The editors plan to complete their publication with several indices in many languages: it will certainly be a scientific instrument of great value. Our only hope is that the printers will treat them with more consideration in the future, for this first instalment is shockingly imperfect from the typographical point of view. The Press al-'ittimād belies its good name; the number of misprints is far too great even for an oriental press; the sheets are wrongly folded and wretchedly bound. In short, the material presentation of this book is far below the level which its substance should deserve: I trust that the Egyptian University will not permit the continuation of such an indignity.

GEORGE SARTON.

Nicolaus de Cusa.—*Opera omnia.* Iussu et auctoritate Academiae Litterarum Heidelbergensis ad codicum fidem edita. II. *Apologia doctae ignorantiae.* Edidit RAYMUNDUS KLIBANSKY. XII+49 p. Leipzig, FELIX MEINER, 1932.

Shortly after the appearance of NICOLAS DE CUSA's principal philosophical work, the *De docta ignorantia* (1440), JOHANNES WENCK of Herrenberg, professor of theology at Heidelberg, issued his *De ignota litteratura* in which he launched a most thoroughgoing attack upon the views expressed by CUSANUS. In answer to this attack CUSANUS wrote his *Apologia doctae ignorantiae* in October of the year 1449. Though he pretended to consider WENCK's work unworthy of his attention—as the disciple says in the *Apologia*, (p. 6, l. 15.): Nam non est sibi visum scriptum illud tanti esse, quod aut legi aut reprehendi conveniat—he could not disregard the criticism of so influential a theologian as WENCK.

The *Apologia* is written in the form of an account, communicated by one of CUSANUS's disciples to a fellow-disciple, of a discussion between him and the master on the merits of WENCK's arguments against the

De docta ignorantia as expressed in his *De ignota litteratura*. The question as to who was the actual author of this dialogue has been a debatable one. KLIBANSKY, in the preface to his edition of the text of the dialogue, gives a brief statement of the problem and offers conclusive proof as to its true authorship. According to him the whole problem as to whether CUSANUS or one of his disciples wrote the *Apologia* arose because of two reasons. First, because CUSANUS, imitating the literary form used by PLATO in his dialogues, wrote in such a way as to give the impression that the dialogue was not written by him, but was recorded and reproduced by another. Secondly, because FABER STAPULENSIS in his Paris edition of the works of CUSANUS made several changes and insertions which but added to the obscurity as to the true authorship of the work. The editor warns the reader against accepting as positive proof of CUSANUS' authorship the statement made by BERNARDUS DE WAGING in his *Laudatorium doctae ignorantiae*, which appeared shortly after the *Apologia*, to the effect that the latter was written " per virum omnia scientem, ipsius scilicet Docte ignorancie auctorem." He goes on to say, however, that now that all the Mss. of the *Apologia* have been collated, there can no longer be any doubt but that CUSANUS was actually the author of that work. The most conclusive proof, to omit others, is the fact that when CUSANUS towards the end of his life completed the edition of his works, he included the *Apologia* among those collected in the codex Cusanus 128, and in the same volume and in his own handwriting signed the scribe's copy stating that he had himself read it through and had approved it.

The *Apologia* has come down to us in nine codices, which the editor lists and describes in clear fashion. Seven of these contain also the *De docta ignorantia*. For a full description of these codices and of the external characteristics of the Mss. of the *Apologia* found in them, the editor refers the student to the preface to his edition of the latter work, since the Mss. of both works were copied almost at the same time and by the same scribe and, consequently, to give that description here would be to repeat himself unnecessarily. For the purpose at hand he limits himself to a brief discussion of some points of interest in the history of the transmission of one of the Mss. of the *Apologia* found in the cod. isleb. 960.

As for the other two codices which contain the *Apologia*, KLIBANSKY merely enumerates them with brief descriptions of their contents, since they present no particular problem or peculiarities. For the aid of the student he gives a diagram illustrating the textual relationship between the various Mss. and printed texts of the *Apologia*.

In addition to a preface—written in Latin—the editor has supplied the text with three critical apparatuses, an index of the philosophers

and theologians who appear in the text, an index of authors, an index of abbreviations, and a list of the codices and editions he used in preparing the text.

In the first apparatus he collates all the Mss. and printed editions of the *Apologia*. In the second, he gives full and accurate references to the various works of philosophers and theologians quoted or paraphrased or indirectly referred to by CUSANUS. In the third, he gives references, according to his statement in the preface (p. VIII), only to the most important of the later authors who either gave expression to their high esteem of CUSANUS or cited from his work.

In his index of authors the editor lists all the authors cited or referred to by CUSANUS in the text, giving very full references to their works by exact edition and passage as well as to all passages in the text where they are cited or referred to.

The editor, Mr. KLIBANSKY, has, it is evident, exercised great care and precision in the preparation of the text as well as the various apparatuses and indices, something for which the student who will make use of the work will be most grateful, in that it will to a very appreciable degree facilitate his use and understanding of the text.

JOHANNES WENCK accused CUSANUS of giving expression to views which reflected the heresies of the Waldenses and Beghards. His criticism of the Cardinal was rendered all the sharper because of the widely divergent views each held in church politics. CUSANUS was a staunch leader in the papal party, while WENCK was an important figure in the party which upheld the rights of the Council of Basle against those of the Pope. WENCK avoided all reference to this matter in his work. CUSANUS, however, sensed this secondary motive in WENCK's attack and referred to their difference on the matter in his *Apologia*. (5. 2 seq.) Though throughout the discussion CUSANUS attempts to treat WENCK's criticism seriously and in a manner becoming the philosophical strictures of a learned theologian, he yet could not refrain from expressing his impatience with the arrogance and superficiality displayed by his opponent. Thus, when the disciple expresses impatience with WENCK who accused CUSANUS, among other things, as being ignorant of logic, the latter replied : " Non te offendat istud. Nam etsi omnium sim ignorantissimus, sufficiat saltim mihi, quod huius ignorantiae scientiam habeam, quam adversarius non habet, licet desipiat..." (21, 7-9) CUSANUS further objects to the manner in which WENCK evidently jumped to conclusions after a superficial glance at the *De docta ignorantia* as well as to his unjust practise of taking passages out of their context in order to find some point of attack. Thus he says of WENCK : " Pauca videtur hic homo legisse et minus, quae legit, intellexisse." (7, 9-10)

Or : " Nunc sic, tunc aliter dicit, quia non legit *Doctae ignorantiae* libellos, nisi ut, si posset, bene dicta confutaret. Hinc nihil intellexit eorum, quae legit." (21, 16-18) The extent to which WENCK misconstrued the text of the *De docta ignorantia* was most disturbing to CUSANUS, and towards the end he answers the arguments read to him by the disciple by merely taking the copy of the *De docta* out of the latter's hands and reading the passages in question letting the very text speak for itself. He was convinced that WENCK with his Aristotelian trend of thought was incapable of understanding the ' docta ignorantia.'

In his attack upon CUSANUS, WENCK raised 37 points on which he accused him of holding heretical views. He struck at the two underlying principles of the latter's philosophy, viz. his theory of the ' docta ignorantia ' and of the ' oppositorum coincidentia.' In replying to these attacks CUSANUS stated in more definite and precise terms a number of the views found in the *De docta ignorantia*. In summing up his evaluation of WENCK's work VANSTEENBERGHE says : ' Le principal mérite de JEAN WENCK restera sans doute de nous avoir fait mieux connaître la position de NICOLAS DE CUSE en le forçant, par ses objections, à préciser sa pensée dans l' « Apologia ». (1)

WENCK started by objecting to CUSANUS's view as to the nature of God. He claimed that it ran counter to the scriptural verse ' Vacate et Videte, quoniam ego sum Deus," according to which God is distinct and separate from His creatures just as they are excluded from the divine being. NICOLAS answers that in arguing from the prophet's use of the word ' ego ' to the conclusion that God is to be rendered distinct and separate from all His creatures, and in basing his whole objection upon that argument WENCK ' pueriliter satis se fundare videtur.' (8, 14) He then takes occasion to restate his own views. No one, he says, (8, 14 seq.) has ever been so void of understanding as to affirm that God is other than that being than whom nothing is greater and who is the principle of existence of all things (omnia formans). Hence God is neither this nor that, neither heaven nor earth, but He is the one who gives existence to all (dans esse omnibus). He is, properly speaking, the form of all forms, and every form which is not God is not truly form, since it gets its existence from the absolute form or God. In view of all this, no existence can be separate from the most absolute, perfect, and simple form (absolutissimae et perfectissimae atque simplicissimae formae), since the latter grants all being. Furthermore, since every being derives from

(1) E. VANSTEENBERGHE : Le " De ignota litteratura " de JEAN WENCK de Herrenberg, Münster, 1910. Intro. p. 18.

this very ' forma ' and apart from it cannot be said to have existence, all existence is necessarily in that forma. Now, all being which is in this absolute form cannot be other than that form itself, since the latter is the infinite, most simple and perfect existence-principle (infinita essendi forma, simplicissima et perfectissima). God must not be conceived as having the same kind of existence which we attribute to individual things, or which is commonly attributed to a genus or species. He is the ' absolutissima forma ' far above all possible, general, specific, or any other sort of form one might conceive or name. He is the ' ineffabilis forma,' the beginning, middle, and end of all forms and at the same time transcending all concepts we may fashion of Him.

It is only through the ' docta ignorantia ' that we can arrive at the true view of the unity of things, at the unification of all contraries. To see God from this point of view is to ' videre omnia Deum et Deum omnia,' and also to realize that we can never fully see Him in this true light. The others see God falsely, since they hold the contraries distinct and resolve all into quantity and multiplicity.

WENCK went on to accuse CUSANUS of boasting that he had received from God the ability to attain the incomprehensible by transcending the fallible powers of human knowledge. After casting many an unjust reflection, which—the disciple hastens to add—did not disturb the equanimity of his master, WENCK quoted I. Corinthians 13, 12 to prove that in his boast CUSANUS contradicted the apostle PAUL. CUSANUS answered that his opponent did not understand the passage correctly. He then offers his own interpretation in support of his views. The truth, he says, can never be seen in an image, for every image falls short of its prototype. But, the one who realizes the true nature of an image immediately sets about to look beyond it to the incomprehensible true prototype. Similarly, he who conceives of all creation as an image of one Creator, sees that just as the being of an image possesses no perfection whatsoever of its own, thus all his own perfection is derived from Him whose image he is. For God is reflected in His creatures just as truth in its image. Realizing that the variety and multiplicity of things in this world are but the image of a single God, man will push beyond these towards the incomprehensible without, however, expecting or being able to conceive it. He will admire with awe that infinite being which is reflected in all comprehensible things as in a mirror, and will understand that that absolute form is at the same time comprehensible to no creature. In this sense is the absolute reality (God) actually incomprehensible. Just as the sun is in a sense invisible not because of lack of light but precisely because of its supervisibility, so God, precisely because of his ' superexcelsam intelligibilitatem,' is unintelligible to us. The ' docta

ignorantia ' or the recognition of the incomprehensible is the only true way to God.

CUSANUS gives a number of quotations from earlier philosophers and theologians in corroboration of his theory of ' docta ignorantia.' Thus, DIONYSIUS called ignorance the most perfect knowledge. ALGAZALI also expressed similar views. AUGUSTINE said that God could be reached through ignorance rather than through knowledge. CUSANUS could very well quote AUGUSTINE, since it was to him that he owed this conception. He restates it concisely in a number of passages in the *Apologia*. In 27, 24-26 : Quia non est scientia, qua quis credit se scire, quod sciri nequit, ibi scire est scire se non posse scire ; in 21, 7-9 as quoted above, and in other passages.

CUSANUS regarded as the central principle of his system the theory of the coincidence of contraries which he derived largely from ECKHART. The disciple raises the point that WENCK could not have understood this theory as expressed in the *De docta ignorantia*, since he attributes to CUSANUS the statement that the creatures are identical with the Creator, and then proceeds to attack him on the ground of that alleged statement. Here CUSANUS goes into a tirade against those who misquote or take passages out of their context to use them to serve the questionable purpose of their argument. As for WENCK's argument, it is nothing short of irrational to say that the image is identical with its prototype, the effect with the cause. From the fact that all things are in God as an effect is in its cause it does not at all follow that the two are identical. As an example, CUSANUS gives the relationship between unity and number, in keeping with his general practise of drawing analogies from the field of mathematics.

Another objection raised by WENCK was that the statement in the *De docta ignorantia* that all things are what they are only in God does away with the existence of things in their own right. CUSANUS decried this falsification of his statements and suggested that the whole objection was rather to be scorned than refuted. Nevertheless, he meets it with the analogous argument that matter is not done away with by the fact that all being derives from form, nor is the part negated by the fact that its existence is dependent upon that of the whole.

To his above objection WENCK added a corollary : the ' universalizantes ' by stripping those things which are in God of their individuality tend to deify those very things. This charge, if it were well grounded, is a serious one, for it is—as DÜR suggests (2)—one of pantheism.

(2) J. M. DÜR : Der deutsche Cardinal Nicolaus von Cusa, Regensburg, 1847. p. 348.

CUSANUS replies that he does not know what WENCK means by the word 'universalizantes.' This much can be known from PAUL and all the Church fathers, viz. that God is in all things and that all things are in Him. Nevertheless, no one assumes a composition of the various things in God (compositionem in Deo-27, 4) since all in God is God (omnia in Deo Deus). Earth in God is not earth, but God. WENCK showed utter lack of understanding when he inferred that the above statement runs counter to the simple nature of God. For just as it is not counter to the simplicity of the unit that all number is embraced in it, so also in the case of the cause and all its effects. In the same way the perfection of God is not diminished. As absolute perfection He must contain in himself all perfections of all things. If He were lacking some particular perfection, He could then be more perfect and would therefore not be infinite.

CUSANUS grants the truth of WENCK's statement that the principles laid down in the *De docta ignorantia* destroy knowledge of the divine. But it is doubtful whether WENCK would have been flattered by this admission, for CUSANUS goes on to explain that it is no knowledge to believe one knows that which one can not know; in the case of God to know is to know that one can not know. (27 : 24-26).

CUSANUS voices strenuous objections against the attribution to him of the actually heretical views of the Begardi. He accuses his opponent of betraying his ignorance in that he passed over the most profound passages, not realizing that they are actually the expressions and terms used by the holy Fathers, and that they were introduced by him into the text of the *De docta* intentionally that he might not overstep the bounds set by them. It is true that in the *Apologia* CUSANUS quotes very extensively from and often refers to the traditional and accepted authorities in order to strengthen his case. He does however include among them men like ECKHART for whose writings he shows great admiration though they were always suspect, and SCOTUS ERIGENA (Scotigena), and his followers AMALRIC OF BENA and DAVID DINANT, whose writings had been condemned by the Church. The presence of such names in a work meant to establish his challenged orthodoxy is puzzling.

The disciple closes the discussion by enumerating a few more instances illustrating the manner in which WENCK misunderstood or distorted the text of the *De docta*. Upon hearing some of the belittling epithets applied to him by WENCK CUSANUS answers calmly 'Omnia quae de caecitate intellectus dicit, plane fateor,' but insists that 'se excellere adversarium in hoc, quod se caecum sciebat.' (34, 1).

The dialogue closes with an admonition by CUSANUS to his disciple that he proceed further in his search for knowledge in the right manner.

This admonition the disciple repeats to his correspondent with the request that he spread the teachings of the master. He predicts with certainty that ' Vincet enim indubie haec speculatio omnes omnium philosophorum ratiocinandi modos, licet difficile sit consueta relinquere.' (36, 8).

The extent to which this prediction has been realized has been a matter of contention. A very definite obstacle in the way towards a solution has been the sad lack of accurate critical texts which could be used as a basis for a thorough study of CUSANUS's system. The plan of the Akademie der Wissenschaften at Heidelberg to issue a complete corpus of CUSANUS's works, of which the *Apologia* forms the second volume, promises to remove that serious obstacle and to supply the student with all the critical apparatus essential to a comprehensive study and evaluation of CUSANUS's position in the history of philosophy.

(*Boston, Mass.*) S. KURLAND.

Giambattista Basile.—*The Pentamerone.* Translated from the Italian of BENEDETTO CROCE. Now edited with a Preface, Notes and Appendixes by N. M. PENZER, M.A. With a Portrait Frontispiece, twelve reproductions of title-pages and other illustrations, together with a contemporary plan of the City of Naples. London : JOHN LANE the Bodley Head Ltd. New York : E. P. DUTTON and Co. 1932. 2 vols. : pp. LXXV+310+VI+334.

It is part of the singular fate of this *Cunto deli Cunti* of GIAMBATTISTA BASILE that, although it appeared at Naples in 1634-36 in the Neapolitan dialect of Italian, not until the first quarter of the nineteenth century did it become known outside of Italy. Even within Italy it cannot be said that it was ever a popular book. In 1816 JACOB GRIMM, at BRENTANO's suggestion, gave ten pages to a translation of one of its stories in his *Taschenbuch* and the Brothers GRIMM gave 89 pages to it in their *Kinder-und Hausmärchen* of 1822. Then only was it fairly launched in the wide world. In 1825 THOMAS KEIGHTLEY, in the first edition of his " Fairy Mythology," gave two stories from it and dealt with the collection in detail in his " Tales and Popular Fictions " in 1834. In the meantime Sir WALTER SCOTT, on his last fatal journey, actually held in his hands at Naples in 1832 one of the original Neapolitan editions and recognized its value, " a dumpy fat 12 mo. edition of Mother Goose's Tales with my old friend Puss in Boots, Bluebeard, and almost the whole stock of this very collection." So he wrote in his Diary, in evident ignorance of the earlier discovery and identification by the Brothers GRIMM.

How had it come about that it took nearly two centuries for the earliest

and greatest collection of folk-tales made in Europe to pass the Alps and become known in the wider world? The answer lies in the character and literary environment of its author and in the ideas which governed him in the construction of his book. He was born about 1575 in or near Naples and grew up speaking the dialect of Naples as well as that Tuscan Italian which was the Italian of literature. He knew thoroughly and loved deeply his native dialect and identified himself with a contemporary movement to make Neapolitan a literary medium. But he wrote in Tuscan also and was a court poet of eminence in the service of several princely patrons. His literary allegiance was given to the Baroque "conceits" of Marinism and he belonged to several of the literary Academies which then flourished in Italy. But he was also a soldier of fortune and some years of his youth were spent in the service of Venice at Crete and in the Greek Isles. It is plain that everywhere folk-tales appealed to him and that their motifs automatically impressed themselves on his memory. And so towards the end of his life he occupied himself with a volume of Eclogues giving descriptions and scenes in the popular life of Naples and with this book of what may perhaps best be called bedevilled folk-tales. The folk-lore motifs are there but they develop in no such kindly and human world—kindly in spite of ogres and witches—as that of the Märchen of GRIMM, nor even in such a more sophisticated fairy land as that of HANS ANDERSEN. They are fantastic rather than fanciful; of a hard shrewdness and a pessimistic realism. Their author had seen and felt much on the seamy side of life and had reacted bitterly to it. As a consequence his fairies make strange appearances and disappearances and their doings are disconcerting. But above all, BASILE in his telling uses the methods of RABELAIS, whether consciously or unconsciously. His object in writing is the greater glory of the Neapolitan dialect as a medium of literature and so he, of deliberate purpose, piles up lists of words and phrases to show in how many ways you can render an idea in it. And his ideas and the handling of them in Neapolitan as in Tuscan are perversely—almost decadently—Baroque and Marinist. We have had the cynical fairy tale, the realistic fairy tale, the improper fairy tale, but BASILE achieved the final ignominy of the "conceited" fairy tale—the mystery of abomination to all children.

And so its fate has proved. His *Pentamerone*—so-called practically from the first whether by himself or not—appeared in parts two or three years after his death in 1632, but it was never popular in the form in which he left it. For modern Italians the book is practically unintelligible as Senatore CROCE found when he tried in 1891 to revive it in its original form. A simplified version into the dialect of Bologna appeared in 1742, and in various editions down to the present time, and had much

better luck. A very poor rendering into Italian appeared in 1747 and eight other, evidently small, editions followed. BASILE's object and method were very effective as handicaps to his book.

But when it was fully recognized how early and important the book was on the folk-tale side its history took a new turn. The full précis by the Brothers GRIMM in 1822 made it free of all folk-lore circles and the complete German translation by LIEBRECHT in 1846 gave yet fuller access. A good English translation by TAYLOR in 1848 did the same for English readers and students. Then the selectors and popularizers in French, German and English got to work and BASILE's tales completely escaped from his rhetoric and returned to their original nursery forms. Of Sir RICHARD BURTON's complete English version of 1893 the least said the better.

Yet it was it which Mr. PENZER first thought of re-issuing in a corrected form. Fortunately he turned instead to the Italian version (1925) of BENEDETTO CROCE and made that his basis. Senatore CROCE has corrected his version and added to its notes. M. PENZER has controlled it throughout from the original Neapolitan editions and has added still more storyological notes. The 60 page introduction on BASILE's life and works, in Neapolitan and Italian, is by CROCE. All the notes, storyological, philological and literary are made accessible by an elaborate index.

Of the value of this English version, difficult and exasperating as it often is to the reader who seeks a story, there can be no question. It renders BASILE faithfully and the exasperation is due to his perverted ingenuity. Yet of at least equal value are two long Appendixes on the Bibliography of the Book and on its place and importance in folk-lore. In Appendix A Mr. PENZER gives most elaborate and exact information on (i) Editions published in Italy in Neapolitan, Bolognese and Italian; (ii) Editions published outside Italy, (a) German translations, (b) English translations; (iii) Partial translations, notices and criticisms; (iv) The Bibliographers of *Lo Cunto de li Cunti*; (v) BASILE's Italian works; (vi) Tables of recorded copies. On this Appendix Mr. PENZER has spent years of labour, travel and research and has himself examined practically all the books and articles described; it covers vol. ii, pp. 167-271. Appendix B is given to Folklore Addenda: (a) The Frame-story; (b) The BASILE-GRIMM analogies; (c) The Folk-tale since BASILE. This last, by Prof. STITH THOMPSON of Indiana University, is easily the best and clearest short statement of the present position of its subject. Very full tables of motifs and tables of motifs and tale-types in the *Pentamerone* follow. The science of the folk-tale is in the making and the only suggestion the present reviewer can offer is that account apparently

is still to be taken of the researches already carried out in the Arabic speaking world. There do not seem to be references here to the folk-tales recorded in Syria, Egypt and North Africa, especially by LITTMANN, SPITTA, VAN STUMME and SPOER. The popular press in Egypt has even printed a number of these in the Egyptian vernacular. In spite of the researches of CHAUVIN and COSQUIN there is still a wide field here.

(*Hartford, Conn.*) D. B. MACDONALD.

(Mersenne, M.) — *Correspondance du* P. MARIN MERSENNE, religieux minime, publiée par M^me^ PAUL TANNERY, éditée et annotée par CORNELIS DE WAARD, avec la collaboration de RENÉ PINTARD, vol. I, 1617-1627, 666 p., Paris, BEAUCHESNE, 1933.

On savait déjà à M^me^ PAUL TANNERY un gré infini d'avoir recueilli les *Mémoires scientifiques* de son mari, dont 11 volumes ont jusqu'à présent paru par ses soins. Voici que, réalisant un des plus chers projets du grand historien de la science, elle entreprend aujourd'hui une publication dont l'ampleur et les difficultés auraient certainement fait hésiter plus d'un savant éprouvé ou plus jeune. Que M^me^ TANNERY nous permette de lui dire tout de suite notre admiration devant un tel dévouement et un si grand courage. Par une touchante pensée, elle a inscrit au dos du livre le nom de PAUL TANNERY comme celui de l'auteur. L'œuvre monumentale qu'elle se propose (il y aura au moins une douzaine de volumes) est éditée avec l'aide de M. C. DE WAARD, dont il serait ridicule de célébrer encore le savoir et le mérite, et avec la collaboration de M. RENÉ PINTARD, ancien élève de Normale, agrégé des lettres.

Le vocable d'amateur appliqué aux savants français du XVII^e^ siècle peut être pris dans deux acceptions. DESCARTES, FERMAT, les deux PASCAL, DESARGUES, MARIOTTE, au point de vue académique, sont des amateurs; en fait, les universités françaises ne représenteront même la science qu'à partir de la seconde moitié du XIX^e^ siècle. Mais d'autre part, au moment où la science commence à prendre la forme qu'elle a conservée, on voit apparaître des intermédiaires, des agents de liaison, véritables touche-à-tout (la spécialisation date d'il y a moins d'un siècle !) dont le rôle a été essentiel, mais dont les noms sont souvent moins connus du grand public. PEIRESC (1580-1637), à qui M. P. HUMBERT vient de consacrer une biographie superficielle et bien pensante, et MERSENNE (1588-1648) sont au premier rang de cette catégorie-ci d'amateurs. Le " très Minime MERSENNE " ne le fut pas autant que le jeu de mots de VOLTAIRE voudrait nous le faire croire.

Dans une brève préface, M. DE WAARD rappelle les raisons de

l'importance que TANNERY attribuait à ce que la correspondance de MERSENNE vît le jour; il expose ensuite les principes de l'édition de la correspondance : celle-ci est conçue au sens le plus large du mot, c'est-à-dire qu'elle comporte non seulement les lettres du religieux, des dédicaces et des extraits de ses œuvres imprimées, mais aussi les lettres de ses correspondants et jusqu'aux extraits de correspondances qui le concernent; en fait, sur les 86 numéros que comprend ce Ier tome, il n'y a que 14 lettres, dédicaces, opuscules et textes divers dûs à MERSENNE lui-même. L'ordre de publication adopté est le seul raisonnable : c'est l'ordre chronologique. Disons que, dès les premières pages, on devine que de cette conception résultera une œuvre digne des grandes éditions de GALILÉE, DESCARTES, FERMAT, HUYGENS, etc. La lecture du volume ne fait que confirmer ce sentiment. Vient ensuite une note sur la vie de MERSENNE; elle contient des pages remarquables sur l'initiation du religieux à l'esprit scientifique (pp. XLIV sq.).

Au commencement de ma lecture, j'avais été tenté de faire une réserve. Il me semblait que les biographies des correspondants de MERSENNE, extrêmement précieuses d'ailleurs, eussent pu être rassemblées à la fin du ou des volumes, alors qu'à présent, il faut les rechercher là où un correspondant apparaît pour la première fois, ce qui eût été un défaut assez grave dans un ouvrage destiné à être consulté couramment. En réalité, ce premier volume se présente comme une véritable Histoire, qui devra être lue d'un bout à l'autre par l'historien de la science non seulement parce qu'il y trouvera la matière d'une foule de notes utiles à ses travaux et à la préparation de ses cours, mais parce que c'est aussi une des plus intéressantes Histoires que nous possédions de ce moment palpitant entre tous dans l'évolution de la pensée scientifique, celui où la science moderne se crée en se désanthropomorphisant. Cette correspondance touchant à tous les domaines (elle sera par exemple indispensable à l'historien de la musique) nécessitait de nombreux commentaires. Néanmoins, à première vue, on pouvait se demander si cette abondance merveilleuse de notes, qui révèle une érudition invraisemblable, atteignant des limites qui n'ont peut-être jamais été dépassées, était justifiée; quoique ces notes soient d'un tel intérêt que l'on est heureux de connaître la correspondance de MERSENNE rien qu'à cause des éclaircissements qu'elle nous vaut, je ne pouvais me défendre de me rappeler notamment le reproche souvent adressé par les communistes au régime capitaliste de provoquer de telles exagérations, et conséquemment, un tel gaspillage d'intelligence. Cependant, insistons sur ce point, l'ensemble du texte et des notes, dont aucune en fin de compte n'est inutile — j'en suis fâché pour Moscou —, constitue une véritable histoire de l'esprit, où de nombreuses pages sont d'un puissant

intérêt (cf. la p. 167) et d'où de multiples conclusions se dégagent. Je m'en vais rapporter en quelques mots celle qui m'a frappé le plus.

Il a fallu la science (qui seule — différant en cela des religions et des philosophies — nous apporte des connaissances positives) pour former l'homme moderne. Mais cet homme est, en réalité, foncièrement identique au primitif. Seul le rôle plus ou moins grand de la pensée affective les sépare. N'oublions pas que le primitif enfonce un clou exactement comme nous. Son mysticisme, corrélatif de son ignorance, n'apparaît que là où son savoir, c'est-à-dire sa technique, s'avère insuffisant. N'en est-il pas de même dans notre civilisation? Nous constatons que sous l'effet des explications mécanistes de l'univers, une idée très importante se répand au début du XVII^e siècle, malgré les efforts de l'Église : on est amené à croire que la notion de création, de commencement du monde ne doit provisoirement pas être prise en considération; au XVIII^e siècle, au siècle des lumières et des philosophes, on enregistre une immense vague d'irréligion pour les mêmes raisons d'ordre mécaniste; et chez l'homme du XX^e siècle, la pensée affective n'est-elle pas aussi puissante que chez le primitif dans certaines manifestations collectives comme le patriotisme ou le nationalisme? Ne l'est-elle pas toujours chez le civilisé quand il s'agit de l'amour ou de sentiments violents et profonds? Je dois à M. L. LÉVY-BRUHL l'anecdote suivante : on avait prêté à VERHAEREN *Les Fonctions mentales dans les sociétés inférieures;* le poète dévora l'ouvrage d'un bout à l'autre; quand il le rendit à son propriétaire, il s'écria : « C'est ainsi que je pense ». Que nous pensions comme le primitif, cela m'avait paru évident en examinant tout récemment une abondante documentation inédite sur la numération, documentation à laquelle nous consacrerons bientôt une étude. J'ai trouvé d'autre part chez les correspondants de MERSENNE bien des exemples frappants de tendances que l'on aurait pu croire propres aux primitifs; documents éminemment significatifs et précieux; voyez par exemple les passages d'une lettre de CLAUDE BREDEAU qui débute ainsi : « Je considère que Dieu s'est servy du nombre de six pour escréer ce monde » (p. 390); « Je considère l'unité... En quoy faisant je contemple une image de Dieu... qui en son unité et individuité contient tout et remplit tout » (pp. 391-2). C'est là du pur primitif. Dans le même ordre d'idées, MERSENNE fait de l'unité le principe de toutes choses (p. 398). Le civilisé pense comme le primitif, sauf quand l'état de la science a développé les conceptions mécanistes au point de rétrécir le domaine affectif où se meut presque entièrement le primitif. — L'attention du sociologue sera attirée par d'autres aspects de la documentation qui lui est offerte. C'est ainsi qu'il pourra se convaincre que le rôle d'un seul esprit dans un milieu déterminé (nous songeons à DESCARTES) ne saurait être surestimé.

Il serait bien intéressant de vérifier si les courbes en cloche représentent fidèlement la production scientifique du XVII^e siècle.

Qu'il me soit permis de terminer par trois remarques. On souhaiterait que la bibliographie des écrits de MERSENNE fût mise en appendice, pour plus de clarté. D'autre part, dans l'index des noms propres, un nombre en italique pourrait désigner la page où l'on trouvera le plus de renseignements biographiques sur une personne. Enfin, il est regrettable qu'il n'y ait pas d'index des matières; absente dans un ouvrage secondaire, une table des sujets traités est ici indispensable. Ce ne sont pas là de bien graves critiques. Le prouverai-je en émettant le vœu que les Anglais, jaloux, s'inspirent du modèle parfait que nous avons sous les yeux pour éditer enfin la correspondance de NEWTON? Le patriotisme ferait ainsi — une fois n'est pas coutume — œuvre d'intelligence.

J. PELSENEER.

Halley.—*Correspondence and papers of Edmond Halley*, preceded by an unpublished memoir of his life by one of his contemporaries and the " Eloge " by D'ORTOUS DE MAIRAN. Arranged and edited by EUGENE FAIRFIELD MACPIKE, member of the History of Science Society, Oxford Historical Society, etc. pp. 300+IX. Oxford, at the Clarendon Press, 1932. (Price $ 5.00).

The main part of this volume (Chapter IV, pp. 37-133) consists of one hundred letters written by HALLEY to various persons. Most of these letters have never been published before. A few of them were published in rare works not easily accessible. Chapter III consists of two lists of letters : from HALLEY and to HALLEY. These lists together with the letters published in the present volume give a good idea of the scope of HALLEY's interests and his extensive circle of scientific friends. Nevertheless it is clear that the material has not been exhausted by Mr. MACPIKE's researches. There are considerable gaps in HALLEY's correspondence in which not a letter from HALLEY has been found. The most prominent gaps are 1682-85, 1687-90, 1716-21 and 1729-42 (the year of HALLEY's death). There certainly must be letters written by HALLEY in these years. The editor is fully conscious of this. He states in the introduction : " HALLEY's other unpublished Letters and Papers, exclusive of his Ms. observations at Greenwich, would, no doubt, when recovered suffice to make a second and, perhaps, even a third volume. The present writer's purpose is to make somewhat more accessible than hitherto all the material to which he has himself gained access, and to provide a key to sources."

To return to Chapter IV. Probably the most interesting letters are those to NEWTON, eight in number. In Letter No. 37, dated

September 28, 1695, HALLEY writes to NEWTON : " I must entreat you to procure for me of Mr. FLAMSTEED what he has observed of the Comett of 1682 particularly in the month of September, for I am more and more confirmed that we have seen that Comett now three times, since ye Yeare 1531, he will not deny it you, though I know he will me." This is the first intimation of HALLEY's most remarkable discovery of the periodicity of the comet since known by his name. This discovery was communicated to the Royal Society on June 3, 1696. Incidentally this quotation throws light on the relations between FLAMSTEED, the first Astronomer Royal, and HALLEY who later succeeded FLAMSTEED at Greenwich. The situation which was strained as early as 1695 later developed into animosity for which HALLEY is little to blame.

HALLEY's relationship with NEWTON is a subject too well known to dwell upon here. The world owes HALLEY much for the publication of NEWTON's " Principia." HALLEY's attitude toward NEWTON is well summarized in Letter No. 39 : " Sr. pray please to command me in any thing you conceive I may be capable to serve you, and you shall be assured that with all readiness I will approve my self."

There are thirty-four letters addressed to JOSIAH BURCHETT, Secretary to the Admiralty, concerning HALLEY's two voyages to the South Seas to observe the variation of the magnetic needle and an expedition to study the tides in the English Channel. They are full of interesting details showing under what conditions a scientific expedition in those times had to work. HALLEY's ship was fired at (Letter 52), he was arrested in Brazil as a pirate (Letter 66), his lieutenant proved disloyal to him (Letter 53) thus necessitating an early return to England, etc.

In fourteen letters to Sir HANS SLOANE, Secretary of the Royal Society, HALLEY discusses various topics from monsters and archeology to eclipses.

Among the rest of the letters four are addressed to FLAMSTEED, five to HEVELIUS, and seven to WALLIS, mostly on astronomical matters. A collotype plate of Letter No. 24 to WALLIS accompanies the text.

Important as this collection of HALLEY's letters undoubtedly is, its usefulness might have been increased by the editor's greater use of explanatory notes. One is struck by the scarcity of footnotes. In most cases the footnotes give only the location of the original. It is certainly too sanguine a hope on the part of the editor to expect the reader to be thoroughly acquainted with the scientific world of HALLEY's time. Nor do the two memoirs on HALLEY, in Chapter I, help much in this respect, as they give only brief accounts of HALLEY's life.

Chapter V contains thirty unprinted papers by HALLEY. They refer mostly to physical experiments and are in my opinion far less interesting than the letters.

Chapter VI entitled " Halleiana " contains twenty-one appendixes on various phases of HALLEY's life, such as HALLEY's ancestry, HALLEY at the Mint at Chester, HALLEY's Character and Personality, Grouped References to HALLEY's Life and Work, Key to Sources of Original Material, etc. It contains also a collotype plate of one of NEWTON's letters to HALLEY.

An especially attractive feature of the volume are excellent illustrations among which are five portraits of HALLEY. This volume is certainly a splendid contribution to the history of science, as it involves not only HALLEY but many of his great contemporaries.

As is well known HALLEY's fame was to a large extent obliterated by that of his illustrious friend, Sir ISAAC NEWTON. It is indeed remarkable that there is no complete biography of HALLEY. The author says in the Preface : " The present volume will not in any way lessen, but on the contrary will increase, the need for a comprehensive biography of HALLEY. If it shall serve to promote the accomplishment of that disederatum, by (as one would hope) an English astronomer, the editor will feel amply repaid for his labours, which in any case have not been without their own reward."

It seems to the reviewer that Mr. MACPIKE is too modest. He is probably best qualified to write a biography of HALLEY which would be indeed a most welcome contribution to the history of science.

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Perkins Observatory N. T. BOBROVNIKOFF.
Delaware, Ohio.

Faraday's diary.—Being the various philosophical notes of experimental investigation made by MICHAEL FARADAY D.C.L., F.R.S. during the years 1820-1862 and bequeathed by him to the Royal Institution of Great Britain. Now, by order of the Managers, printed and published for the first time, under the editorial supervision of THOMAS MARTIN, with a foreword by Sir WILLIAM H. BRAGG. Vol. I, Sept., 1820-June 11, 1832. XXVIII+430 p., 2 pl., figs. Vol. 2, Aug. 25, 1832-Feb. 29, 1836. XVII+467 p., 2 pl., figs. London, BELL, 1932 (to be completed in seven vols., only 150 sets costing £ 12.12.0 each).

FARADAY's laboratory notebooks were bequeathed by himself to the Royal Institution, and have remained ever since its greatest literary treasure. We must be grateful to its Managers for giving them now to the world. Every thing which concerns so great a man as FARADAY is of importance, and what could be more important than his daily

scientific notes? Sir WILLIAM H. BRAGG explains this very clearly in his foreword.

FARADAY " was in the habit of describing each experiment, in full and careful detail, on the day on which it was made. Many of the entries discuss the consequences which he would draw from what he had observed. In other cases they outline the proposed course of a research about to be undertaken. Thus the Diary is far more than a catalogue of results. The reader is able to follow advance, step by step, to final and fundamental conclusions. He sees the idea forming, its experimental realisation, and its employment as a foothold for the next advance.

The results of FARADAY's researches were described by him in papers contributed, for the most part, to the Royal Society. They were collected by him in his well-known *Experimental Researches*. The demonstrations and arguments of the Diary have therefore been given to the world already. The main interest of the Diary lies, however, quite outside the range of propositions and experimental proofs. It centres round the methods of FARADAY's attack, both in thought and in experiment: it depends on the records of the workings of his mind as he mastered each research in turn, and on his attitude not only to his own researches but also to scientific advance in general.

FARADAY is generally held to be one of the greatest of all experimental philosophers. Nearly every science, is in his debt: and some sciences owe their existence mainly to his work. The liquefaction of gases, benzene, electromagnetic induction, specific inductive capacity, lines of force, 'magnetic conduction' or permeability, the dark discharge, anode, cathode, magneto-optics, electrochemical equivalent; all these terms suggest fundamental researches which he made, and many of them were called into existence in order to describe his discoveries. It is extraordinary that a man who did such excellent work, should also have excelled in his description of it."

Volume 1, dealing with the period Sept. 1820 to June 1832, contains such items as: experiments on the liquefaction of gases (1823), isolation of " bicarburet of hydrogen," i.e., benzene, and determination of its composition and reactions (1825). The electromagnetic experiments were begun on Aug. 29, 1831, with decisive results on the very first day!: magnetism produced by an electric current (the reciprocal of OERSTED's experiment of 1820). By March 26th of the same year FARADAY had already grasped the core of the matter, witness the following extract—which will illustrate the neatness of his notes:

" 403. The mutual relation of electricity, magnetism and motion may be represented by three lines at right angles to each other, any one of which may represent any one of these points and the other two lines the other points. Then if electricity be determined in one line and motion in another, magnetism will be developed in the third; or if electricity be determined in one line and magnetism in another, motion will occur in the third. Or if magnetism be determined first then motion will produce electricity or electricity motion. Or if motion be the first point determined, Magnetism will evolve electricity or electricity magnetism.'' (p. 425).

Vol. 2 covers the period August 25, 1832-Feb. 29, 1836. It contains such items as these : Magnetic effects of common electricity ; electro-chemical decomposition ; definition of a current, quantity and intensity ; electro-magnet ; Voltaic and common electricity ; electro-chemical equivalents ; fluorine and its compounds ; protection of iron from rusting ; Voltaic battery ; zodiacal light ; electro-magnetic induction ; self-induction.

The edition has been prepared with fastidious care. FARADAY's original drawings are reproduced in the margins and references to his published writings are indicated in the table of contents, thus making as easy as possible the comparison between his original notes and his final conclusions. It would be foolish to try to publish in the same style the laboratory notes of many investigators, but it is well that it be done in one case at least. If this principle is admitted, one could not have chosen a better example than FARADAY, not only because of the immense importance of his researches, but also because of the excellence of his notes. Philosophers and psychologists are given here materials of the very first order.

Each volume contains two plates : the first, a portrait of FARADAY (unfortunately undated and unexplained), and a facsimile of the entry recording the first successful experiment in electro-magnetic induction (August 29, 1831) ; the second, a view of the Royal Institution (c. 1840), and a facsimile of the letter written by W. WHEWELL to FARADAY on May 6, 1834 advising the use of the terms " anode " and " cathode."

Five more volumes will be needed for this publication. As they will be used more generally for reference than for straight reading, it is hoped that elaborate indices of names and subjects, discarded technical terms, etc. will be provided at the end of the last volume.

G. S.

G. Contenau.—*Manuel d'archéologie orientale depuis les origines jusqu'à l'époque d'Alexandre.* 3 vols. 1686 p., 974 fig., 4 cartes hors texte. Paris, AUGUSTE PICARD, 1927-31.

Cette admirable encyclopédie de l'histoire de la civilisation et surtout de l'art dans l'Asie Occidentale pendant une période de près de quatre millénaires ne peut pas se résumer ; il n'est même pas possible de l'analyser en détail, car l'analyse la plus brève deviendrait assez vite d'une longueur démesurée. Le mieux que nous puissions faire c'est d'en examiner le but, le plan d'ensemble et les méthodes, et puis de discuter quelques points particuliers à titre d'exemples.

Le but est ainsi défini par l'auteur :

« Sous le nom de Manuel d'Archéologie « Orientale », terme un peu vague,

mais d'acception assez définie en France pour qu'il n'ait point paru possible d'en adopter un autre, nous étudierons comme on le fait généralement : l'Elam (la Perse ancienne), la Mésopotamie, la Syrie qui comprend la Haute-Syrie et la Palestine, enfin la partie est de l'Asie-Mineure, qui constituent la presque totalité de l'Asie occidentale. Nous constaterons d'ailleurs, que ces pays correspondent à l'aire de dispersion des écritures cunéiformes et que c'est l'histoire artistique des civilisations ayant adopté cette écriture que nous retracerons. Simplement l'histoire de leur art, car la nomenclature des travaux qu'ont suscités ces diverses civilisations, pendant les trente dernières années, dépasserait à elle seule le cadre de cet ouvrage. Il était donc nécessaire de limiter le sujet et nous avons choisi d'étudier les monuments. Nous restons ainsi sur un terrain plus ferme; une sculpture est quelque chose de tangible, un point de départ assuré; les monuments figurés de l'Asie Occidentale sont relativement nombreux; les dater est souvent possible, au moins avec approximation."

Et plus loin il précise l'orientation de son enquête comme suit (p. 2) :

« C'est par comparaison avec l'Egypte et l'Egée que nous apprécierons la culture générale de l'Asie Antérieure. Mais l'étude de ces éléments nous conduira à d'autres constatations. Jusqu'ici, on a accoutumé de considérer deux grandes races initiatrices : les Indo-Européens à qui nous devons la civilisation européenne, et les Sémites à qui l'on attribue celle de l'Asie Occidentale. Cette opinion à laquelle invitaient les témoignages de la Bible s'est trouvée renforcée par les premières découvertes assyriologiques; elles nous ont fait connaître l'Assyrie et la Babylonie du premier millénaire avant notre ère, dont le langage était sémitique. Depuis, on a constaté l'importance, pour la formation de la civilisation assyro-babylonienne, des Sumériens qui ne sont pas des Sémites et, tout autour de la Mésopotamie, on a reconnu l'existence d'une série de peuples qu'on nomme les Asianiques, qui ne sont pas non plus des Sémites, et dont la culture a des points communs avec celle des Sumériens. En même temps, l'histoire nous a enseigné le rôle prépondérant joué dans le progrès des peuples de l'Asie Occidentale par les Aristocraties; j'entends la suprématie d'un petit groupe de conquérants capables, par leur culture supérieure, d'imprimer une direction à la masse des habitants d'un pays. Toutes ces données ont conduit à reviser une question qui paraissait résolue : l'origine de la civilisation de l'Asie Occidentale. Il nous faut faire désormais une large place aux éléments asianiques; non qu'il faille dénier aux Sémites une influence; ils constituent un facteur important, mais, comme les Arabes lors de la conquête islamique, ils ont adopté et mis en valeur la culture qu'ils ont rencontrée lors de leur venue en Asie Occidentale. »

Le premier volume contient d'abord des " Notions générales " (p. 1-354). Celles-ci se subdivisent ainsi (je n'indique que les points principaux) : I. Les sources. Auteurs hébraïques, grecs et latins. Les voyageurs. Les fouilles. Musées. Publications. II. Le milieu physique. III. Le milieu ethnique. IV. Histoire et chronologie. V. Le langage. Langues asianiques, sémitiques, indo-européennes. VI. L'écriture. Les écritures cunéiformes et hieroglyphiques. Les scribes. L'alphabet. VII. Les liens entre les sociétés. Religions asianiques et sémitiques. Les lois.

Une des préoccupations constantes de M. CONTENAU est de faire le départ entre les éléments " asianiques " antérieurs et les éléments sémitiques postérieurs (e.g., p. 15, 86). Une autre, c'est d'indiquer la multiplicité et le caractère fragmentaire des relations commerciales (e.g., p. 66, 77, 79) et comme résultat le mélange de races nombreuses depuis la plus haute antiquité. Par ex. (p. 84), en Babylonie on trouve des Sumériens primitifs et des Elamites, des Sémites d'Agadé et de la Première Dynastie, les Gouti du Zagros, les Kassites d'Elam, les Perses ; en Syro-Phénicie, des Sumériens (du moins ceux-ci ont-ils laissé des traces), des Egéens, Egyptiens, Amorrites, Hittites, les Peuples de la mer. A propos des fouilles de Byblos, l'auteur remarque (p. 870) qu'aux influences locales, égyptienne, suméro-akkadienne, haute-syrienne, s'ajoutent même des éléments caucasiens.

A la p. 355 du vol. 1 commence la deuxième partie de l'ouvrage, Histoire de l'art, qui se continue jusqu'à la fin à travers les trois volumes. D'abord (I) des généralités sur l'art de l'Asie Occidentale ancienne : art essentiellement religieux ; caractéristiques de l'architecture et de la sculpture ; traditions iconographiques, divisions géographiques (art sumérien, élamite, babylonien, assyrien, perse, hittite, " syro-cappadocien " et " syro-hittite," phénicien, judaïque). II. L'art archaïque de l'Elam (en Perse) et de Sumer (basse Mésopotamie) à partir du 36e siècle env. (1), p. 394-664. III. La monarchie d'Agadé. Les Gouti. GOUDEA. La IIIe dynastie d'Our (du 28e siècle au 24e), p. 665-796. IV. Les rois d'Isin et de Larsa. La première dynastie babylonienne jusqu'à HAMMOURABI (du 24e siècle à la fin du 21e), p. 797-872. V. Le deuxième millénaire, p. 873-1121. VI. Le premier millénaire, p. 1123-1498.

L'ouvrage comprend une bibliographie étendue répartie à la fin de chacun des volumes. L'index est abondant, mais quelques sondages m'ont cependant convaincu de son insuffisance. Ceci est moins une critique qu'une indication de la richesse des informations que 40 pages d'index ne parviennent pas à épuiser.

Je justifie ma critique. Il y a à la p. 1246 une note importante sur l'usage du fer déjà assez répandu à l'époque de SARGON II (722-705) : l'index ne permettrait pas de la retrouver. A la p. 1272, l'auteur discute le transport des taureaux colossaux en pierre, tel qu'il est décrit dans les bas reliefs de SENNACHÉRIB (705-681) du British Museum: l'index ne contient pas le mot transport. Il ne contient pas les mots cheval, chameau, selle (voir p. 1275, 1277), étrier (p. 1275) ; ni le mot magie, si important

(1) Il y a beaucoup de divergences de vues au sujet de ces chronologies (voir résumé p. 1616-19). Les chiffres que je cite sont ceux que l'auteur a finalement adoptés et qui sont plus courts de 100 à 150 ans que ceux donnés par lui-même dans le corps de l'ouvrage.

(voir p. 1306), ni le mot tunnel qui serait indispensable pour qui aurait oublié le mot Siloé ; ni les mots meghazil ou fuseaux (p. 271, 1465). Le mot bateau ne renvoie pas à la p. 1535 comme il le devrait. Le mot autruche est absent, et œuf d'autruche ne donne pas l'indication principale (p. 1524) où est discuté le fameux œuf trouvé dans la tombe de l'étendard (nº 779) à Our, — sans doute l'œuf d'autruche le plus ancien dans l'histoire de l'art.

On a l'impression que l'index des noms de personnes et de lieux a été établi avec soin (2), mais que l'index des choses a été négligé. Il semblerait que l'auteur se soit intéressé davantage à la forme des monuments et à leur signification artistique qu'à leur signification scientifique. Sinon aurait-il permis que tant de matériaux relatifs à l'histoire de la culture passent inaperçus faute d'être indexés ?

Les figures sont fort nombreuses, et leur sources littéraires sont indiquées, mais on ne nous dit pas toujours où se trouvent les objets représentés, et quelles sont leurs dimensions.

Je n'ai rencontré que peu d'omissions et peu d'erreurs. En voici quelques unes. BENJAMIN DE TUDÈLE vivait au XII^e siècle, pas au X^e (p. 10). Je n'ai trouvé aucune mention des monuments du Nahr al-kalb près de Beyrouth. Le sarcophage dit d'ALEXANDRE n'aurait pas du être discuté, car il est évidemment postérieur à l'époque d'ALEXANDRE, mais je reconnais qu'il était fort tentant de l'inclure.

Voici qui est plus grave. Je n'ai trouvé aucune discussion des poids et mesures, à part deux brèves allusions aux lions de bronze du British Museum (p. 1304, 1446). A ce propos, je me demande si les deux lions de bronze du Louvre surmontés d'anneaux, celui de Khorsabad et celui de Suse, ne furent pas primitivement conçus comme poids, quelle qu'ait été leur destination ultérieure. L'auteur a étudié à fond les collections du Musée de Constantinople ; est-il possible qu'il n'y ait pas vu les admirables poids portant des inscriptions cunéiformes ? J'ai devant moi la photographie de l'un d'eux (nº 7878, cliché du Musée nº 3370). Ce poids en forme de canard s'impose à l'attention par sa valeur artistique autant, sinon plus, que par son intérêt scientifique. Pourquoi M. CONTENAU a-t-il négligé ces monuments d'une importance fondamentale ? (3)

L'historien de la science trouvera peu de choses qui le concernent

(2) Cependant Tell-Halaf et Tell el-Halaf (même lieu) sont séparés. OPPENHEIM est incomplet.

(3) Un catalogue de ces poids a été publié en 1918 par ECKHARD UNGER : *Kaiserlich Osmanische Museen. Katalog der babylonischen und assyrischen Sammlung.* III, 1. *Gewichte und gewichtsähnliche Stücke* (XVIII+40 p., Konstantinopel, Ahmed Ihsan, 1918). Ce catalogue est par trop sommaire et je n'ai pu y identifier le beau canard dont j'ai la photographie.

directement dans cet ouvrage, pour la simple raison que l'auteur ne s'occupe pas des textes, mais seulement des monuments. Nous n'avons pas le droit de nous en plaindre, et d'autant moins que l'ouvrage tel qu'il est, nous sera extrêmement précieux. Mais il est fâcheux que les rares monuments qui nous intéressent, les poids et mesures, soient complètement omis.

Le volume I a été rédigé en 1926 ; et les deux autres volumes étaient déjà remis à l'imprimeur en mars 1930. Il ne faut donc pas s'étonner si l'ouvrage n'est plus au courant. Cependant l'auteur a pu ajouter avant la fin de l'année 1931 quelques appendices fort importants (p. 1499-1602).

I. La céramique peinte de l'Elam, celle de Sumer, et la population primitive de l'Asie occidentale ancienne. II. Le déluge babylonien. III. Les sépultures sumériennes et les tombes royales d'Our (bon résumé des fouilles merveilleuses d'Our, p. 1509-63, mais beaucoup de travail a été fait depuis). IV. Les tombes royales d'Our et les découvertes dans le Caucase et dans la région de la mer Caspienne (depuis lors l'exposition persane de Londres a précisé nos connaissances). V. L'Egypte et l'Asie devant l'histoire. " Il paraît sage de surseoir à des conclusions fermes sur le mécanisme de transmission des influences asiatiques en Egypte ; qu'elles soient indéniables, c'est ce que nous retiendrons de cet exposé." (p. 1599). Une brève note finale se rapporte aux fouilles de Ras Shamra, et au moment même où j'écris ce compte rendu, je viens de lire le dernier rapport de M. CLAUDE F. A. SCHAEFFER (4) sur la découverte de tombes mycénéennes à cet endroit. Ras Shamra nous réserve encore de grandes surprises.

Pendant mon séjour en Asie l'an dernier, j'ai pu constater l'activité fébrile des fouilleurs dans beaucoup d'endroits. Nos connaissances se multiplient et se précisent tous les jours, et il est à peine possible de publier un manuel comme celui-ci qui soit tout à fait complet au moment de sa publication. Mais noblesse oblige ; et j'espère de tout cœur que M. CONTENAU nous donnera bientôt un supplément, arrangé dans l'ordre même de son grand ouvrage. Un supplément serait plus facile à préparer qu'une nouvelle édition et serait plus utile. Le monde savant lui en serait profondément reconnaissant.

GEORGE SARTON

A. Delatte.—*La catoptromancie grecque et ses dérivés.* 221 pp. XIII pl., Bibliothèque de la Faculté de philosophie et lettres de l'Université de Liége, fasc. XLVIII. Imp. H. VAILLANT-CARMANNE, Liége. 1932.

(4) *Illustrated London News*, Feb. 11, 1933.

This study of the history of divination by a mirror or a polished surface, such as a sword, precious or semi-precious stone and the like, is the result of researches made by the author in connection with the editing of certain texts of his *Anecdota Atheniensia*. Ancient Greece was the home of this form of divination, the earliest allusion being found in ARISTOPHANES where two usages characteristic of the Middle Ages are already indicated, namely, replacing of the mirror by any other reflecting object, and the use of oil on the object to make the reflection brighter. Two types of catoptromancy have existed side by side throughout the ages—the one of a psycho-physiological nature without appeal to the supernatural, relying upon the excitation of the senses by brilliant reflecting surfaces, the other of a character both religious and demonological, resorting to incantations, conjurations, invocations of both God and demons. Other forms of divination and magical rites are frequently found associated with catoptromancy, especially hydromancy and crystallomancy, but the author carefully distinguishes these.

The author begins with a discussion of catoptromancy during the Middle Ages (since he finds little evidence of it among the Romans), for only by a study of its later history can the Greek texts be understood. The first mediaeval references to the divinatory mirror occur in texts of the eighth century. However, DELATTE finds the first discussion of such magical rites in the *Polycraticus* of JOHN OF SALISBURY, while the most ancient formula used in its practice comes from the *Liber introductorius* of MICHAEL SCOT (still inedited, but the Mss. of which are listed in HASKINS, *Med. Sci.*, p. 287, n. 95.) The methods and ideas of the famed but little known magician "ARTESIUS" (SARTON, *Introd.*, II, 219) were certainly those of Greece. The most detailed accounts of the practice of catoptromancy are to be found in WILLIAM OF AUVERGNE, HARTLIEB, and the author of the *Astronomia magna* (which DELATTE believes is wrongly attributed to PARACELSUS), and later writers give evidence of its practice almost to the present day.

As for the oriental world, DELATTE considers that AL-KINDĪ gives the earliest evidence of the practice of catoptromancy, and this not in its purest form. A tenth century text, *Abrégé des merveilles* (translated from the Arabic by Baron CARRA DE VAUX) is more definite. Further references occur in AL-BAKRĪ, MAIMONIDES, IBN SĪNĀ, IBN KHALDŪN. The real divinatory mirror among the Arabs has been replaced by a mirror of ink and its use is very extensive at present, having been carried even to India. Thirteen plates showing the practice of catoptromancy are appended. A full bibliography is to be found in the notes.

This study illustrates the lengths to which it is sometimes necessary to go in order to understand certain texts, and it suggests the possibility

of similar researches into other phases of magical practices, which, since discussed topically, might be regarded as companion volumes to THORNDIKE.

Columbus, Ohio. HARRIET P. LATTIN.

K. Chimin Wong and Wu Lien-teh.—*History of Chinese medicine.* Being a chronicle of medical happenings in China from ancient times to the present period. XVIII+706 p., frontispiece, 92 illus., map. Tientsin, The Tientsin Press (no date ; general preface dated Shanghai, July 15, 1932). Price : 30 s. or G. $ 7.50.

We published in *Isis* some years ago (vol. 14, 255-63) an elaborate review of FRANZ HÜBOTTER's : *Die chinesische Medizin* (Leipzig, 1929). The present work had already been on the stocks for a long time when HÜBOTTER's book appeared. Though it is much larger than HÜBOTTER's, its scope is much wider too for it includes modern medicine—Western or Chinese under Western influence—as well as the original Chinese medicine. Part I devoted to the latter is the only part comparable with HÜBOTTER's work and it is considerably smaller (123 p. against 356). The author of that first part, K. C. WONG, lecturer on medical history at the National University, Woosung, Shanghai, seems to have worked independently of his predecessor ; in fact, his Western sources are overwhelmingly English or American.

Part I is divided as follows :

A. The ancient or legendary period (2697-1122 B.C.). 1. Beginnings of Chinese healing art; 2. Founders of Chinese medicine; 3. Relationship between religion and medicine.

B. The historical or golden period (1121 B.C.-960 A.D.). 4. The philosophy of disease; 5. Famous ancient physicians; 6. The *Nei Ching* or Canon of medicine; 7. Medicine conditions during the Chou dynasty; 8. The great trio : TS'ANG, CHANG and HUA; 9. The doctrine of the pulse; 10. Influence of Taoism and Buddhism on medicine; 11. Cultural aspects of the Han and T'ang dynasties; 12. Standard works of the historical period.

C. The mediaeval or controversial period (961-1800 A.D.). 13. The period of intensive specialism; 14. Leading physicians of the Sung dynasty; 15. Medical schools and state examinations; 16. The four famous doctors of Chin Yuan; 17. The *Pen T'sao Kang Mu* or great herbal; 18. Medical sects of the Ming and Ch'ing dynasties; 19. Cultural and social aspects; 20. Early obstetrics, gynecology, ophthalmology, parasitology, leprosy, beri-beri, cholera, smallpox, syphilis, castration, medical jurisprudence; 21. List of important works.

The illustrations of part I are numerous (45) ; some are well chosen, others not so well and their value is sometimes much decreased by the lack of source indications. Referring the reader to my previous discussions of acupuncture and moxibustion (*Isis*, 14, 262 ; *Introduction*,

2, 78), he will find interesting illustrations of it on p. 30, photos showing moxa scars forming a geometrical pattern, and p. 32, life size bronze figure of the Sung dynasty showing the *hsüeh* or acupuncture points. This part I is completed by a valuable index of Chinese books (p. 120-23).

The second part was composed by Dr. Wu Lien-teh, Director of the Manchurian Plague Prevention Service. It deals with modern medicine—Western medicine in China—and is almost five times longer than the first. For the Chinese medical public and the legion of Western men and women who have devoted their lives to the medical education of China and the defence of its people against every form of disease, this second part will be by far the more interesting. It is illustrated with a number of portraits—Western and Chinese,— views of hospitals, etc. The following table will give an idea of the abundance and variety of its contents :

1. Period before A.D. 1600. Early contacts between China and Western medicine; 2. Period between A.D. 1600 and 1800, dealing mainly with the influence of Catholic missionaries; 3. Introduction of Jennerian vaccination against smallpox in China and its further progress in the country; 4. Period 1820-1842. Permanent introduction of Western medical methods by the surgeons to the East India Company and the first Protestant medical missionaries; 5. Period autumn 1842-1855. Consolidation and expansion of early medical missionary work; 6. Period 1856-1865. Characterised by intensive individualistic efforts; 7. Period 1866-1879. Adoption of new methods for medical work; 8. Period 1880-1885. Marked by considerable progress in medical education; 9. Period 1886-1893. Early consolidation of medical efforts; 10. Period 1894-99. Describing (a) The spread of plague in China leading to the great outbreak at Canton and Hongkong in 1894 and (b) Further consolidation of medical efforts; 11. Period 1900-1910. Formation of proper Union medical schools and systematic training of nurses; 12. Period 1911-1920. Overthrow of the Manchu dynasty and the first Manchurian plague epidemic. Beginnings of modern public health work under Chinese leadership; 13. Period 1921-1930. Substantial progress in public health and other medical activities mainly under direction of Chinese physicians; 14. General survey and outlook; 15. Chronology of medical events in China (p. 605-41).

There is a portrait of Dr. Sun Yat-sen (Sun Wen, 1866-1925) in the frontispiece, and another one on p. 296 together with views of the Canton Hospital where he studied and of the room which he occupied.

An excellent feature of this book is that all the Chinese names are not only consistently romanized (Wade's system) but the Chinese characters are quoted as well. There are full indices of persons and subjects for each part. I would not venture to appraise the book at once, for its degree of accuracy will only be measurable after a longer use of it, but it seems to have been compiled with care.

The authors state in their preface :

" The aim of this book is twofold. To students of the old school, with their

praiseworthy efforts to preach and retain the admittedly manifold virtues of the ancient order, the account of how the modern conception of the prevention and treatment of disease came to gain a footing in this conservative land should make inspiring reading and yet serve as a reminder that the world (particularly medical science) has not remained stationary since the time of HUA T'O. On the other hand, protagonists of experimental medicine, in their laudable attempts to inculcate the spirit of scientific research into the masses, are urged not to spurn the lessons of the past but to see in the old tradition, not something to be rejected, but a background that throws into vivid relief the wonderful achievements of the present age."

I would suggest that it will also answer a third purpose. It will prove the greatness of the task accomplished with unremitting devotion by thousands of " foreign devils " for the good of China.

GEORGE SARTON.

Virgile Pinot.—*La Chine et la formation de l'esprit philosophique en France.* (1640-1740). 480 p. GEUTHNER, Paris, 1932.

Documents inédits relatifs à la connaissance de la Chine en France de 1685 à 1740. 130 p. GEUTHNER, Paris, 1932.

The two volumes belong together as parts of a single study. While histories of Western philosophy generally ignore the matter it is a fact of increasing interest that a knowledge of Chinese institutions and ideas exerted an influence in the seventeenth and eighteenth centuries upon European liberal thought. M. PINOT here places before us valuable new materials for studying the case in France. At two critical junctures in her reflective life France became especially sensitive to knowledge concerning China introduced by Jesuit missionaries. These were about 1685 when all traditional ideas, religious political and ethical were beginning to be sifted, and about 1760 when philosophers and economists were seeking to set up a social science which should serve as a basis for politics and morals alike. The most brilliant exponent of this Oriental interest from the point of view of literary history is VOLTAIRE who has not infrequently been considered as " le grand propagateur du ' virus ' chinois " (p. 11).

In the books before us, however, VOLTAIRE is not the central figure. His treatment awaits a further volume. The author traces rather the slow growth of one hundred years (1640-1740) during which Jesuit missionaries furnished materials upon which scholars in France worked and reflected in various ways. The study rests upon a wide documentation, of which the *Documents inédits* form a part. The details may be read in the thirty-six pages of carefully classified bibliography for which future students will be thankful. M. PINOT's critique of Jesuit writings on China makes it clear that many more were sent to

Europe than were made public by the Jesuits of Paris. The latter are certainly not impartial. There is definite evidence of suppression of texts, omissions and corrections, uniformly in the direction of supporting Jesuit positions in the famous controversy over Chinese rites. The result is an interpretation of the ancient Chinese which makes them believers in a creator God and the immortality of the soul, passes in silence their belief in spirits, makes Chinese chronology accord with that of the Bible, refers Chinese religion to the same sources as Judaism and Christianity, and finds Chinese ethical ideas not necessarily contrary to Christianity. The new information concerning China, however, suggested other interpretations to other minds. NICOLAS FRÉRET, in truly historico-critical fashion, sought to prove the authenticity of Chinese history by itself apart from all religious ideas. Non-Jesuit missionaries and philosophers such as BAYLE contended that the Chinese are atheists in order to destroy the theistic argument from universal consent. LEIBNIZ, on the other hand, seeking arguments for natural religion defended the original theism of the Chinese. Chinese morals and politics became for many an interesting instance of universal ethical principles arising naturally from human experience apart from religious authority. The whole study leaves the impression that attention to Chinese culture during this period sprang primarily from diverging currents of thought seeking fresh support for positions which tendencies of the time were forcing apart.

Documents inédits consists for the most part of valuable correspondence concerning Chinese astronomy and history which passed between NICOLAS FRÉRET and different Jesuit fathers in China during the eighteenth century. FRÉRET, who was a true historian and one of the best critical spirits of the period, was especially interested in the chronology and antiquity of Chinese history. His letters, running from 1709 to 1737, show that the missionaries on both of these matters held opposed judgments which furnished FRÉRET stimulating material on which to exercise his critical acumen. Students of French ideas in the eighteenth century as well as sinologists will find these documents worthy of attention because of their revelation of tendencies which in those days affected the interpretation of China. The manuscripts, which were collected originally by the astronomer DELISLE passed after his death to the library of the astronomical observarory of Paris where M. PINOT had access to them.

In these days when interest in the Orient is strongly on the increase M. PINOT's two books are especially significant for our understanding of the earlier stages of our Western awareness of China. The eighteenth century had its own preoccupations but it realized that a great new field of fact was emerging which Western reflection cannot escape.

M. PINOT analyzes the situation with the skill of a historian and the insight of a philosopher. His work is a substantial contribution.

Oberlin College. CLARENCE H. HAMILTON.

Richard T. Cox.—*Time, Space and Atoms.* 154 pp. Baltimore : The WILLIAMS and WILKINS Company, 1933. Price $ 1.00.

In cooperation with the Century of Progress exposition a series of volumes is being issued presenting the essential features of those sciences which are the basis of modern industry. The present little book is an attractive popular exposition and interpretation of the concepts of contemporary physics.

The book opens with chapters on the velocity of light, the space-time manifold of relativity and the reduction of gravitation to geometry. The author then describes the properties of wave motion, the properties of atoms, electrons, protons, and photons, and concludes with an account of quantum mechanics and atomic structure.

Many popular books on physics are appearing at the present time. In the opinion of the reviewer the present book is among the best. The literary quality is excellent; the author employs a wealth of fresh terminology and original analogies and diagrams. Although the book is offered as a popular account the author illuminates the exposition with historical background and philosophical interpretation. The book is the expression of an imaginative and cultivated mind.

The reviewer found the chapter on Geometry and Gravitation particularly attractive. The following comment by the author, however, is subject to misinterpretation. " If the theory of relativity had been developed before the Newtonian theory, it is doubtful if anyone would ever have offered the Newtonian theory as an alternative " (p. 60). In the opinion of the reviewer the development of the Newtonian theory was a necessary prerequisite to the theory of relativity. For science progresses by successive approximations. A first approximation, such as the Newtonian theory, is necessary in order to define the conditions under which the higher approximation is verified. Indeed, the calculation of the quantities which reveal the inadequacy of the Newtonian theory requires the prior determination of other quantities by the Newtonian theory, for example, the mass of the sun. Historically it is unlikely that the theory of relativity could have been formulated without the prior development of the Newtonian theory. From the experimental point of view the exact relativistic theory could not have been applied to experience without the prior detailed application of the first approximation.

University of California V. F. LENZEN.
Berkeley.

W. T. Stace.—*The Theory of Knowledge and Existence.* XII+455 p. Oxford University Press, 1932. (Price $ 5.00).

One is always delighted to find a book epitomized so ably by an introductory quotation. The volume under review takes as its text the following statement from HENRI POINCARÉ : " It matters little whether the ether really exists ; that is the affair of metaphysicians. The essential thing for us is that everything happens as if it existed, and that this hypothesis is convenient for the explanation of phenomena. After all, have we any other reason to believe in the existence of material objects ? That, too, is only a convenient hypothesis."

It is thus made clear at the start that the author has planned a book on epistemology and the basic premise is revealed. He begins with certain postulates on knowledge and the determination of truth and proceeds by empirical analysis to construct his world of things and his world of ideas about things. In particular, he divides knowledge into five classes : Mathematical, Categorical, Logical, Scientific and Historical.

At the outset Dr. STACE affirms his position as a dualist. He sees nature and its activities on one hand and man and his constructs about nature on the other. " How does a public external world of real objects differ from a world of mere presentations ? ... (1) They have an *independent* existence. And by this use of the word independent I mean that they are believed to exist even when they are not presented to my consciousness. And (2) they are not private to my personal consciousness but are parts of a common world of knowledge which is shared by a multitude of minds. Finally (3) they exist for more than one of the senses." His awareness of this world is in terms of his *given*. " The starting point of knowledge is my given. And my given consists in the phantasms and appearances which occupy consciousness within my self-enclosed ego."

Proceeding from the thesis that " the philosopher only makes explicit what is already implicit in the mind," the author enumerates these mental constructs which form the bridge between the solitary mind and other minds. These constructions, recorded below, form the essential theme of the book :

" I. The presentations of one mind bear to the corresponding presentations of other minds the relation of resemblance.

" II. The corresponding presentations of different minds are identical and there are not many universes, but only one.

" III. The presentations of a mind may continue in existence unperceived by that mind, provided that some other mind is aware of them.

" IV. Presentations may exist when no mind is aware of them.

" V. There exist ' things ' or ' objects,' which are not identical with presentations ; and the presentations are ' qualities ' of the things ; and the ' qualities ' may change while the ' things ' remain the same.

" VI. With the different senses we may perceive the ' same ' objects, and the worlds of the different senses are, in general, identical with one another."

Upon these constructions the author then proceeds to examine particular fields of knowledge. He affirms a belief in " necessary truth " which he expects to find in such a discipline as mathematics. He appears to believe that there is necessary truth in the proposition $2 + 2 = 4$. This ancient controversy is incorporated into the philosophical system of the author in these words : " The proposition is true because it agrees with the empirical facts." It is worth while, perhaps, for us to pause a moment and consider the implications involved in this statement.

We are not indulging in sophistic controversy when we call attention to the very fundamental rôle of such a proposition in the theory of knowledge. It is just here that the *a priori* and the *a posteriori* aspects of mathematical epistemology are most clearly revealed. In justification one can refer to the celebrated page 379 of WHITEHEAD and RUSSELL's " Principia Mathematica," where in the midst of formidable symbolism we find these English words : " From this proposition it will follow, when arithmetical addition has been defined, that $1 + 1 = 2$." Even the logical proof of this simple statement requires a tremendous scaffolding and there are some who doubt whether the proof is without flaw. How much more difficult, then, is the situation when the proposition is made to refer to the world of facts, that is to say, when *one* is a denominate number? To this question P. W. BRIDGMAN devotes considerable attention in his " Logic of Modern Physics," where he shows that there exists a " penumbra of uncertainty," however small it may be reduced by modern instruments of precision, about every physical object and that this penumbra extends necessarily to the denominate number one. The mathematician has carried his investigations into the theory of point-sets and here the uncertainty of logic attains huge proportions as we find in the controversy between the schools of DAVID HILBERT and L. E. J. BROUWER. We need cite only the celebrated aleph-zero with which GEORG CANTOR explored the continuum. This famous number does not obey the law of addition which the author asserts as a necessary truth since the addition of aleph-zero to aleph-zero is again aleph-zero. To those who wish to believe that this is only a mathematical frenzy engendered by a too-blinding inspection of infinity, we would call attention to the fact that EINSTEIN's celebrated addition formula in the realm of physical velocities is an experimental example of a similar addition.

The velocity of light added to the velocity of light is again the velocity of light. If one protests that the linear property of addition has been sacrificed by the EINSTEIN formula, it is only necessary to move to hyperbolic space for the addition to preserve this property. It is unfortunate that the author does not appraise the present status of mathematical truth in its relation to this interesting controversy which has grown since the days of DEDEKIND from the proportions of a mêlée to those of a war with numerous battle fronts.

From mathematical certainty the author then proceeds to categorical, logical and scientific certainty. He divides categorical knowledge into *necessary* and *not necessary* classes and these into facts and constructs. Among the necessary facts he cites : Being, quality, unity and plurality, identity ($A \equiv A$), diversity, and relation. Among the not necessary facts he places causality and reality. The constructs, existence, identity, ($A \equiv B$), substance and possibility, he classifies as not necessary.

Proceeding to logic the author raises his lance against those who would challenge the inevitable necessity of logic. "The necessity of logic is in itself, self-determined, absolute and ultimate. From an epistemological point of view this result is of importance since it indicates that knowledge, tied to the given, is also tied conceptually at this point by logical laws. There are thus two points at which the line of knowledge is tied, though it perhaps hangs free between them." In matters that remain so dark to the mathematical investigators of ZERMELO's postulate (that every class can be arranged as a well ordered series) and in such controversy as has raged around BROUWER's attempt to extricate logic from its paradoxes by a denial of the law of the excluded middle, one is constrained to move with caution. The inevitability of logic is a dubious postulate; its inevitability as a bridge from experience to our interpretation of experience is a curious postulate from one who has made such notable contribution to the understanding of HEGEL.

The fascination of philosophy resides in no small degree in its cosmic sweep. We are thus prepared to find the author passing in brief review the pageant of scientific achievement. Although earlier in the book the author takes exception to the view point of pragmatism, he uses good pragmatic doctrine in his appraisal of the problem of the ether. "Thus the ether bears everywhere the marks of being a creation of the mind,... something made to fit into an awkward hole in knowledge. And now that with relativity physics, it is apparently no longer needed by the mind which gave it birth, it is quietly relegated to the limbo of non-existence. Very clearly the question whether it exists or not is simply the question whether the mind has need of it. Existence is nothing else but what the mind needs to build its world."

The stimulating volume of Dr. STACE concludes with an appraisal of historical knowledge and the problem of truth and error. The author's treatment of these problems remains consistent with his view that the world is a dualism with givens and constructs tied together by an inevitability that resides in logic. In defense of his system, however, it must be emphasized that the author does not assert a rigid scheme by means of which his dualism is known and constructed, but mindful of the dictum of POINCARÉ that if one explanation exists then there exist an infinity of others, he is willing to admit many paths to knowledge.

We thus see that the author has written a very interesting volume. Nowhere is one left in doubt as to the meaning intended. The sentences are incisive and clear. One accepts or rejects the postulates according to his own system of epistemology, but he will find here a real challenge to his thought.

(*Indiana University*.) H. T. DAVIS.

Victor F. Lenzen.—*The Nature of Physical Theory*. (*A Study in the Theory of Knowledge*). XII+301 p. JOHN WILEY and Sons, New York, 1931. (Price $ 3.50).

It is with pleasure that the reviewer finds so competent a resumé of the theories of modern physics so closely related to their philosophical implications. This book should prove to be a very valuable source of information for the philosopher who is seeking to recast his epistemology in the light of the new laboratory and conceptual knowledge ; it should prove equally valuable to the physicist who desires to understand the philosophical implications of his new knowledge and their relationship to ancient problems. The book is divided into four parts. (I) Special Classical Physical Theories ; (II) Unitary Systems of Physical Theory ; (III) The Quantum Theory ; (IV) Methodological Principles.

According to the author the book " stands between the popular expositions of physics and the detailed treatises for experts." A casual survey will convince one that the book is far from a popular exposition since it contains an extensive mathematical formulization of both modern and classical physics. One finds, for example, an adequate summary of vector analysis, a resumé of the electro-magnetic field equations of MAXWELL together with an account of the modifications introduced by LORENTZ in his theory of the electron, and a mathematical survey of the laws of thermodynamics. The special theory of relativity is set forth with sufficient mathematical discussion to make it technically intelligible. An account of GAUSS's theory of surfaces followed by RIEMANNian geometry and the formulas of parallel displacement give an adequate basis for the discussion of EINSTEIN's theory of gravitation

in its tensorial dress. The BOHR theory of the atom and its abstract generalization by the matrix and wave mechanical theories follow. In a word it is difficult to point to a volume in which so many difficult theories are summarized by means of their basic formulas as in the volume of Dr. LENZEN. It is natural to expect that the experimental basis for the mathematics of natural phenomena must be lightly touched.

A philosopher, however, is one among us who has the privilege of cosmic views. His systems must synthesize all knowledge as it unfolds before the advancing army of science. The author of this book is to be especially commended for having blended so well the formal aspects of natural philosophy with their interpretations. It is to be hoped that this volume will form a real bridge of understanding for the philosophers who have delayed entrance into modern metaphysics because of the difficulty of the mathematical way.

The author may be tentatively classified as a dualist. " The physical order is assumed to be objective, that is, it may be known by several minds." He wishes to avoid as far as possible the pitfalls which beset such solutions as " subjectivism, monistic realism and dualistic realism" and he adopts the position that " in the construction of a physical theory one employs a subjectivistic criterion of reality and assumes a realistic attitude."

In a brief investigation of the *a priori* elements in physical theory the author finds these grounded in the definitions of the fundamental concepts, although these are to be regarded as neither categorical nor permanent. " The a priori element... is subject to transformation, both in the light of theory and experience." In consideration of physical concept Dr. LENZEN commits himself to P. W. BRIDGMAN's theory of the operational nature of knowledge. " A physical concept expresses a relation which is set up by an operation, and the concept is defined by the description of operations."

What does the author believe about infinity? It is curious that this idea does not intrude explicitly into his philosophical picture. It is doubtless not with design that those particular disciplines in which this fruitful concept is invoked most frequently have been omitted from the discussion. There is no mention of the expanding universe, or of cosmic radiation with its frequencies asymptotic to an elusive limiting value. The first and second laws of thermodynamics are described, but the third law (the heat theorem of NERNST), particularly as it appears in the suggestive researches of P. DEBYE (*Annalen der Physik*, (4), vol. 39, 1912), is scrupulously avoided. In this law the integral of entropy evaluated from the point of a physical singularity with regard to temperature brings the concept of infinity sharply into view. The wave theory

of SCHRÖDINGER is competently developed but no mention is made of that phase of it which has, perhaps, the greatest interest for the philosopher. We are confronted with a situation in which the continuous and the atomic views of nature are in sharp conflict. We have radiations which are mostly continuous by nature and by mathematical concept, but which possess certain atomic attributes; we have electrons which are mostly atomic but possess undulatory properties that are intelligible only on the basis of some form of continuous propagation. This anomalous situation in which physical quantities possess attributes long believed mutually contradictory by philosophers, demands heroic measures for its solution. What is the real basis of the SCHRÖDINGER theory? One finds it in the title of his original paper: "Quantization as a Problem of Characteristic Values" (*Annalen der Physik*, (4), vols. 79 and 80, 1926). Characteristic values for what boundary value problem? As one must expect in a solution which reconciles two contradictory philosophical concepts the boundaries must be infinite. The conceptual difficulties are thus thrust into this inaccessible region where so many logistical theories have found their refuge. One can derive profit in contrasting this with the equally clever solution of HEISENBERG in which the difficulties are referred to an infinitesimal region bounded by elements of momentum and length and of a magnitude of the order of PLANCK's constant within which the postulate of determinism fails.

In his last two chapters which compose the section on "Methodological Principles" the author makes his main philosophical orientation. He appraises criteria of truth, the nature of substance, physical constants, invariants, and the problem of causality. Mindful of the dictum of POINCARÉ that there is no uniqueness in postulates of explanation, Dr. LENZEN recognizes that "several sets of assumptions may yield the same experimental result." Coherence is therefore to be found in measurement. "The concept of substance is an expression of the rational demand for unity in the representation of physical order" says the author, and he therefore concludes that "we thus arrive at a symbolic representation of physical reality. Physical quantities are symbols which may be represented by matrices."

The rôle of causality as a postulate in physics is envisaged as "the primary expression of unity in physical theory." The difficulties of this basic concept are traced through classical dynamics, the theory of fields, and the quantum physics. The curious fact, often commented upon, that time appears implicitly in the differential equations of classical physics is regarded as an expression of "the succession of cause and effect." In the physics of fields the principle of causality is traced to the boundary condition problem of mathematics in which a unique

solution of a differential system is obtained by a proper choice of boundary conditions. The difficulties of the quantum theory from the causal point of view are resolved, in spite of HEISENBERG's indeterminacy principle, by means of the assumption of a statistical causality in which the anomalies are thrust back upon the determination of the proper probability function.

Indiana University. H. T. DAVIS.

Arthur F. Bentley.—*Linguistic Analysis of Mathematics.* 311 p. Bloomington, Indiana : The Principia Press, 1932.

Contemporary mathematics is characterized by an interest in foundations. There is the logistic of WHITEHEAD and RUSSELL, the program of which is to deduce pure mathematics from logic. There is the intuitionism of BROUWER, who denies the applicability of the law of excluded middle to infinite aggregates. There is the meta-mathematics of HILBERT, who interprets mathematics as the study of symbols and their interrelations.

The author of " Linguistic Analysis of Mathematics " aims to go beyond the existing systems of foundations. The exposition of a set of postulates requires the use of linguistic tools which are much inferior in precision to mathematical symbols. The author seeks to establish a firm construction for this embedding language. He says, " Now, however, the ' Anschauung ' and all similar presentations are themselves ' words,' members of that great linguistic field within which the Hilbertian ' Zeichen ' form one section. The factual reference and validity of these words can hardly be regarded as so definite and certain as to furnish off-hand and without further examination a firm basis for mathematical foundations." " HILBERT's own great step in advance over the previous forms of attack contains within itself the germ of the suggestion that experiment should be made to push it one stage further, so as to cover the full system of linguistic materials used in the search for mathematical consistency as well as the system of specifically mathematical ' Zeichen.' " The author proposes to eradicate inferior forms of expression by a terminology which is defined by a fully clarified postulation. Such postulation is called semantic ; the procedure is free from all control external to the system, the only criterion is internal consistency. Semantic postulation is distinguished from realistic postulation in which the elements are assumed to represent external reality.

In a manner that reminds one of WHITEHEAD the author invents a new terminology which is designed to be free from the ambiguities of conventional language. He analyzes the views of KRONECKER, POINCARÉ, WEYL, BROUWER, HILBERT, etc. and exhibits many infelicities in the

use of linguistic materials by these writers on foundations. In particular, the author emphasizes the need of distinguishing between thing, relation and operation in postulate theory. In a criticism of CARATHEODORY's proof that Null is a " Zahl," he shows that there is confusion between Zahlen and Zeichen. Of interest is a proposed proof, in opposition to CANTOR, that the class of decimals is denumerable.

In view of the meticulous analysis of the language employed by writers on foundations the book should be stimulating to specialists in the subject. It is to be emphasized, however, that the author offers no finished system, but an experiment in interpretation. He says, " There is no contribution here offered to the symbolic organization of mathematics itself." For the most part an expert knowledge of foundations is presupposed by the book. The third part, however, contains a general discussion of knowledge and logic, including an interesting survey of the various contemporary attempts at reconstruction in logic. A valuable feature of the book is the extensive bibliography of the writings of BROUWER, WEYL, HILBERT, etc. on the foundations of mathematics.

University of California, Berkeley. V. F. LENZEN.

Robert T. Gunther.—*The Astrolabes of the World.* Based upon the series of instruments in the LEWIS EVANS collection in the Old Ashmolean Museum at Oxford, with notes on astrolabes in the collections of the British Museum, Science Museum, Sir J. FINDLAY, Mr. S V. HOFFMAN, the MENSING collection, and in other public and private collections. Volume II. *The Western Astrolabes.* VIII p. and pp. 305-610. Frontispiece, plates LXIX-CLIII, and figures 140-217. University Press, Oxford, 1932. (Price of vols. I and II, £. 10.10.0).

The first volume, *The Eastern Astrolabes*, was reviewed in *Isis*, XX, 310-16. More than two-thirds of the second volume consist of descriptions of astrolabes classified as Spanish, Italian, French, Flemish and Dutch, German, and English, and of reprints of treatises ; then follow short chapters on mariners' astrolabes and on astrolabe clocks, two papers by THEODOR WÅHLIN—*Astrolabe clocks and some thoughts regarding the age and development of the astrolabe*, and *The availability of the astrolabe for the construction of sundials*,—finally, a chapter on the astrolabe literature, a bibliography, addenda, and an index.

Reprints of several important treatises are incorporated into the book : HENRY BATE's *Magistralis compositio astrolabij* (A.D. 1274) precedes the descriptions of the astrolabes classified as Flemish and Dutch ; *De mensura astrolabii* and *De utilitatibus astrolabii*, by HERMANNUS CONTRACTUS

(cf. *Isis*, XVI, 200-19, 1931) precede the description of the German astrolabes ; a facsimile of R. TANNER's *The Travailers Joy and Felicitie* (London, 1587), and excerpts from BLUNDEVILLE *His Exercises* (London, 1613) are inserted in the chapter on English astrolabes, while facsimiles and excerpts from *De astrolabii canones* (A.D. 1480) by ROBERTUS ANGLICUS appear at the end of the book, hanging in the air. It is hardly necessary to point out that J. DRECKER's edition of *De mensura astrolabii*, with an introduction, diagrams, and notes, which appeared in *Isis* in 1931, made the 1932 reprint superfluous ; the GUNTHER reprint of *De mensura astrolabii* consists of the bare Latin text, based apparently on the PEZ edition of 1721 as reprinted in MIGNE.

The volume on *The Western Astrolabes*, like the volume on *The Eastern Astrolabes*, contains a rich store of material for the study of the history of these astronomical instruments. This study remains to be made. The arrangement of the material in volume two shows that the author realized the difficulty of a classification " by nationality." The chapters on mariners' astrolabes and on astrolabe clocks, and the papers by THEODOR WÅHLIN, Architect to the Cathedral of Lund, show what can be done if the functional features of the instruments rather than the stylistic or epigraphic inessentialities are taken as a basis for the classification of the heterogeneous instruments broadly designated as astrolabes.

The futility of a classification of scientific instruments " by nationality " is illustrated by such items as 163, 172, 190, 197, 293, among many others. The " Spanish " astrolabe 163 " may be of French rather than of Spanish origin." Item 172 is the ring described by " Bonetus de Latis Hebraeus, Medicus Provenzalis " ; to quote the author : " ...although the treatise of Bonetus was written by a Frenchman, and was printed by a German, yet the dedication to the Pope shows this astrolabe to have been designed for use in Italy, and it is among Italian instruments that we now place it." The " French " saphea 190 in the South Kensington Museum " is now labelled ' Syrian,' but Syrian it certainly is not." Concerning the " French " astrolabe 197, the author says : " The name of the maker, *Hooft*, engraved on the back of the Astrolabe, suggests a Flemish or Dutch origin, and as the Latitude plates are for latitudes 49° and 50°, and though the instrument was considered by Dr. E. B. Knobel to have been constructed for use in Germany, I prefer to consider it French." The " English " astrolabe 293 " has been described by the authorities at South Kensington as a German Astrolabe of the XVIth century ; the author is " inclined to regard it rather as English and of the XIVth century "—and the evidence he presents seems to support his thesis ; incidentally, the rete of this astrolabe is

zoomorphic, " of a peculiarly interesting type which we trace to a Spanish source." The style of the rete always interests the author more than the merely scientific features of the instrument. Concerning the diagrams of the Chaucerian manuscripts he says : " These diagrams show that the plates were marked with almucantars, azimuths, and the planetary hours ; and, what is of greater importance, they show the style of the rete." It seems to the reviewer that the importance of the " nationality " of the instrument and of the style of the rete are overemphasized by the author.

In many instances the author is too laconic in his descriptions. The clockwork of astrolabe 198 deserves more than a line and a half. " A unique instrument " may be a good characterization of astrolabe 216, but it is not very explicit. The " very unusual " astrolabe 238 deserves a photograph, especially in a lavishly illustrated book mentioning Sir J. FINDLAY's collection on the title page. The author's prefaces to the chapters on Spanish, French, Flemish and Dutch, and German astrolabes consist of less than a page each, and must be very disappointing even for the reader primarily interested in questions of " nationality " or of style ; the chapters on Italian and on English astrolabes have no prefaces at all ; there is no preface to the volume as a whole. The author leaves it, apparently, to the reader to find out the specific differences between Italian and English instruments, or the generic characteristics of Western—as opposed to Eastern—astrolabes.

" The time for a comparative study of astrolabe texts is hardly yet come " (p. 367). The reviewer disagrees with this opinion. A comparative study of astrolabe texts and of the instruments themselves can be undertaken now—and GUNTHER's work can be used as a source, if not for the texts, at least for the instruments. The volume under review contains, e.g., enough material for the writing of well documented chapters on planetary, astrological, geographical, or navigational astrolabes ; the suggested chapter titles are but samples of one of several possible classifications. The historian of the astrolabe will have to study the members of a family of scientific instruments, not merely a collection of fascinating objects of art.

The information contained in the chapter entitled Literature is, unfortunately, not always reliable. Thus, SEBASTIAN MÜNSTER's connection with the University of Tübingen is by no means certain ; on the other hand, it is quite certain that ORONCE FINE never " had the good fortune to have studied under Sebastian Munster at Tübingen ; " hence, " Fine's mathematics " did not come " second in direct descent from that greatets of European exponents of the Astrolabe " (viz., Stöffler), and he did not carry " the torch of his special learning into a new

country "—good astrolabes were at home in France before ORONCE FINE was born. There are other similar historical lapses.

The figures on plates CV and CVI should have been interchanged, so as to face the descriptions given on pp. 424 and 425 respectively; a reference to pl. CVI should be added to item 257. There is confusion in the references, under items 243 and 244, to the unnumbered plates XCIX to CIII. There is confusion in the dating of VOLCHAMER's astrolabe, item 281, Pl. CXXI.

The typography and the illustrations of the volume under review are excellent; JOHN JOHNSON, Printer to the University, has produced another beautiful book.

Widener Library, 189. ALEXANDER POGO.

Alfred N. Disney with Cyril F. Hill and Wilfred E. Watson Baker.—*Origin and Development of the Microscope.* 303 p., 30 pl., 36 fig. The Royal Microscopical Society, London, 1928.

This work consists of two parts, the first being historical and the second a catalogue of microscopes and accessories in the collections of the Royal Microscopical Society of London. The editor, Mr. ALFRED N. DISNEY, is responsible for the historical survey of the early progress of optical science in Part I, which with its richly annotated bibliography constitutes half of the book. This is a welcome addition to the history of optics and especially of the microscope. In it an attempt is made to survey the progress of optical ideas from the earliest times down to 1673, the date of publication of the first volume of the "Machina Coelestis" of HELVETIUS. This date marks the point in the evolution of the microscope at which it attained the condition of considerable efficiency and reached a stage of development, comparable in a primitive way to its modern form.

In the preface the editor justly emphasizes the necessity of exercising the critical faculty in estimating the significance of passages in the ancient writings which have been supposed by some authorities to reveal a knowledge of optics and the use of lenses and of spectacles, though neither the writer nor the context reveals a scientific knowledge of optics comparable with that of EUCLID, PTOLEMY, and ALHAZEN in this field.

Fortunately, we find here not merely opinions, but actual citations of pertinent literature. Salient passages are quoted *in extenso* from the original authorities. Thus we find quotations from the "Optics and Catoptrics" of EUCLID, and the "Optics" of CLAUDIUS PTOLEMY. Doubt is cast upon the authenticity of the use of the burning mirror by ARCHIMEDES at the siege of Syracuse (214 B.C.) to fire the Roman fleet.

Contemporaries do not refer to it. GALEN (130-200 A.D.) says that the destruction was by combustibles (*πυρία*) and LUCIAN ascribes it to art (*τέχνη*). The first recorded story of the mirror is by ANTHEMIUS (6th century), the architect of St. Sophia. No successful military use of the device is known, though BUFFON, using 128 mirrors at a distance of 150 feet, was able to fire wood.

Roman writers contributed nothing to the advancement of optics. The great Arabian scientist ALHAZEN (962-1038 A.D.) in his " Opticae Thesaurus " described the anatomical structure of the eye and sought to interpret the optical functions of its parts. Binocular vision he explained as due to the combination of the two images by superposition in the common optic nerve. In this way a singular impression is produced upon the mind. Color is something akin to light and subject to similar laws. He experimented freely and writes of reflection, refraction, and vision through a sphere.

Antiquities throw little light on ancient optics. MAYALL (*Jour. Roy. Micr. Soc.*. 1883) vigorously denies that the Nineveh lens (725 B.C.) was intended for optical purposes. PETRIE regards the glass objects shaped like plano-convex lenses as not intended for magnification. There is said to be absolutely no evidence in ancient literature of the systematic application of such objects to any industrial or scientific uses. It is difficult, however, to be certain that the magnifying properties of such baubles would long remain unknown.

ROGER BACON shows a wide acquaintance with the optical knowledge of the ancients and sought to apply his knowledge to practical matters. His discussion of vision at a distance which led to the view that he had invented a telescope is now abandoned and there is no conclusive evidence that he invented or knew of spectacles, which, according to WILDE, were first reported in 1299 A.D.

In the 16th century substantial contributions were made to optics by the Italian school of opticians, partly with a view to the perfection of spectacles. While the mathematical theory of the lens was still very immature, its main properties were clearly defined and glass makers perfected their methods and became renowned in Venice for their skill. Compound optical instruments appeared and the camera obscura came into use. The work of MAUROLYCUS, CARDAN, PORTA, and CABEUS in this period is summarized.

An age of progress in optics (1591-1660) was illumined by the work of GALILEO and KEPLER with the invention of the telescope in its two dioptric forms, the Galilean and the astronomical. But microscopy lagged behind telescopy, for the stars were evident, but animalcules were not as yet attracting attention. In 1645-1655 KIRCHER and SCHOTT

were classifying microscopes, and in 1655 PETRUS BORELLUS published his " Centuria " of microscopical observations.

In the first edition (Rome, 1646) of KIRCHER's " Ars magna lucis et umbrae ", Tenth Book, p. 834, mention is made of an optical instrument designated as " Smicroscopium investiganda." After referring to sundry micriscopic observations on plants, animals, and so forth, he says: " I omit here what numbers of things might be discovered... about the verminous blood of fever-patients and countless other facts hitherto unknown by all medical men and investigated by none of them." He describes six kinds of these instruments, but figures only two. In the second edition (Amsterdam, 1671) KIRCHER figures a " Smicroscopium parastaticum " with a lens, tube, and mirror. GASPAR SCHOTT in his " Magia Universalis Naturae et Artis " (1657, pp. 533-538) drops the initial letter *S* and describes six classes of microscopes. Beyond a casual reference to the revealing power of two convex sections of a glass sphere, elliptic and hyperbolic, when applied to aerial atoms, BORELLUS gives no hint of the instrument used in preparing the figures of his " Centuria " (1655). The word microscope is, however, first used by GIOVANNI FABER of the Academy of the Lyncei in a letter written in 1625, referring to GALILEO's instrument.

The invention of the compound microscope took place between 1591 and 1621. Authorities differ as to the inventor or inventors, and the instrument was at first much confused with the telescope.

The researches of Professor P. HARTING, based partly upon a letter of WM. BORELIUS, Ambassador at the Court of LOUIS XIV, leads him to conclude that the microscope was actually invented by ZACHARIAS and JOHN JANSSEN, father and son, at Middelburg, Holland, about 1590, and that the Dutchman, CORNELIUS DREBEL, later acquired one of JANSSEN's instruments.

A very fully annotated bibliography with quotations of pertinent passages pertaining to the discoveries leading up to the invention of the compound microscope closes Part I.

Part II is an illustrated classified catalogue of the historical collection of microscopes in the possession of the Royal Microscopical Society of London.

March 28, 1933. C. A. KOFOID.

Tadeusz Bilikiewicz.—Die Embryologie im Zeitalter des Barock und des Rokoko. Arbeiten des Instituts für Geschichte der Medizin an der Universität Leipzig. Band 2. 183 p., 18 figs. Leipzig, GEORG THIEME, 1932. (7 M.)

This booklet covers much the same ground as F. J. COLE's *Early*

Theories of Sexual Generation (1930, *Isis*, 16, 463-5), and seems to have been written at about the same time, although published later. COLE's book is not cited by the author. It deals perforce mainly with the problems of generation rather than embryology as usually connoted today. The philosophic interest in the origin of the individual far outran all concern with structural development in the 17th and early 18th centuries. It was a period of speculation about spontaneous generation and much strife of ovists and animalculists. To the Baroque period our author assigns HARVEY, DE GRAAF, W. NEEDHAM, who founded dynamic developmental concepts of the middle of the 17th century, and DESCARTES, BORELLI, and WILLIS, who are cited as proponents of mechanistic functionalism, while to REDI, MALPIGHI, SWAMMERDAM, MALEBRANCHE, and LEEUWENHOEK, is credited the undermining of spontaneous generation and the introduction of preformationistic theories.

The transition from the Baroque to the Rococo was characterized by the strife between the animalculists, HARTSOEKER, LEIBNIZ, and ANDRY, and the ovists, VALLISNIERI and BOURGUET, and the reaction of vitalism against mechanism, and of epigenesis against evolution.

The Rococo period saw the rebirth of epigenesis under the leadership of MAUPERTUIS, RÉAUMUR, JOHN NEEDHAM, and BUFFON, and a revival of a form of evolutionary ovism by ALBRECHT VON HALLER, BONNET, and SPALLANZANI. Epigenesis reached its final triumph over the evolution and mechanism of these two periods in the work of PATRIN, BLUMENBACH, and CASPAR FRIEDRICH WOLFF.

January 5, 1933. C. A. K

J. J. Galloway.—*A Manual of Foraminifera.* James Furman Kemp Memorial Series. Publication No. 1. XIV+483 p., 42 pls., The Principia Press, Inc., Bloomington, Indiana, 1933.

The field of micropalaeontology inaugurated by EHRENBERG (1854) in his " Mikrogeologie " has taken a new lease of life since 1917 with the use of the fossil Foraminifera of the oil-bearing strata as guide-fossils. At present there are about 300 palaeontologists investigating Foraminifera largely in the interests of petroleum exploitation. Since 1826, when ALCIDE D'ORBIGNY published his first paper on these marine Protozoa, there have been published over 4.000 papers by about 800 investigators who have proposed 1.100 generic and over 9.000 specific names.

Because of the significance of slight differences in the relative dating of ages, zones, and horizons by these microscopic guide-fossils, palaeontologists have been prone to utilize, far more than zoologists generally who do not deal with the succession of forms in time, these small differences in the distinction of species. The author rejects the oft-repeated

opinion that the Foraminifera have changed but little with the passage of geologic time. He admits that the simpler and more primitive types have longer geologic ranges than the specialized types, but finds that the latter have evolved and specialized in a multitude of ways.

The work opens with a historical survey of the contributions of D'ORBIGNY, DUJARDIN, M. S. SCHULTZE, WILLIAMSON, REUSS, CARPENTER, PARKER, JONES, SCHWAGER, BRADY, NEUMAYR, RHUMBLER, EIMER and FICKERT, LISTER, DOUVILLÉ, SCHUBERT, and CUSHMAN, to the classification and especially to the varying bases of classification.

The author bases his taxonomy of this large group on phylogeny. Chronogenesis, or occurrence in geologic time, does not demonstrate phylogeny, since all ancestral forms may not be preserved, or as yet discovered, and primitive, specialized, and even degenerate stages, often occur in the same fauna. Prior to 1927 most systems of classification were largely based on comparative structure. The author uses the biogenetic law, or recapitulation, aided by the known geologic range of each group as guiding principles in his phylogenetic arrangement of the 542 genera, 60 subfamilies, and 35 families which he recognizes. The seriation of chambers in the linear or coiled shell enables the taxonomist to trace the recapitulation of generic stages through which its ancestors have passed in their evolution. Recapitulation in the Foraminifera is palingenetic, not cenogenetic, with new larval characters as in insects. It is possible to trace in the Foraminifera the evolutionary phenomena of acceleration, retardation, atavism or reversion, abundant illustrations of orthogenesis, convergence, isomorphism, parallelism, adaptation, phyletic stages, extinction or extermination, and provincial and cosmopolitan faunas. From the historical point of view this work represents current palaeontological utilization of the accumulated historical data of the actual evolution of this highly diversified group.

March 10, 1933. CHARLES A. KOFOID.

Le docteur **Duguet**. — ***Le pèlerinage de la Mecque au point de vue religieux, social et sanitaire***. Préface de JUSTIN GODART. XII+357 p., 8 pl. Paris, RIEDER, 1932 (30 fr.).

La première partie (115 p.) de cet ouvrage, consacrée à la description du pèlerinage, quoique bien faite, n'a guère d'importance, car il existe déjà beaucoup de descriptions de ce genre — beaucoup plus détaillées — et il devient difficile de dire du neuf à ce sujet. Plusieurs de ces descriptions ont été enrégistrées dans *Isis*, et deux ouvrages y ont été discutés assez longuement, celui de MAURICE GAUDEFROY-DEMONBYNES (Paris, 1923; *Isis*, 8, 209-10) et l'excellent traité arabe d'IBRAHIM RIF'AT pacha : *Mir'āt al-ḥaramain* (2 vols., Le Caire, 1925; *Isis*, 9, 130-33). Cette

partie se termine par une description (plus brève encore que les précédentes) des pèlerinages chiites aux quatre villes saintes de Mésopotamie : Nedjef, Kerbela, Kasimieh et Samarra. On sait que ceci concerne non seulement les vivants mais aussi les morts qui sont dirigés en grand nombre vers ces villes saintes pour y être enterrés. Par exemple, à la seule station de Hanikine il est passé de 1875 à 1891, 663.300 pèlerins avec 96.766 cadavres (p. 111).

Mais passons à la deuxième partie « Le pèlerinage au point de vue sanitaire » qui constitue le principal apport de cet ouvrage et que l'auteur était admirablement équipé pour écrire par ses fonctions d'Inspecteur général du Conseil sanitaire, maritime et quarantenaire d'Égypte.

Un grand mouvement social comme le Pèlerinage musulman, qui cause annuellement la concentration en un seul lieu de foules immenses venues de beaucoup de pays différents (1) doit nécessairement avoir des répercussions médicales. Cependant jusqu'au milieu du siècle passé ces répercussions étaient fort atténuées par la lenteur des communications et la longueur des voyages. Il était assez difficile de transmettre des maladies aiguës de la Mecque à des lieux distants, car les pèlerins qui avaient subi la contagion et y étaient sensibles avaient tout le loisir de mourir avant d'arriver à destination. Les caravanes étaient de véritables « quarantaines ambulantes », dont la sage lenteur (4 km. par heure avec de longues haltes) permettait aux épidémies de s'éteindre dans le désert (e.g., p. 139). L'introduction de la locomotion à vapeur allait changer ces conditions radicalement. Jusqu'au début du XIX^{e} siècle, le choléra était resté cantonné dans son berceau, l'Inde. Il en sortit en 1817, en 1823, invada l'Europe pour la première fois en 1830, et la Mecque en 1831. Après cela il y eut de nombreuses épidémies, mais le danger augmenta considérablement en 1858 quand la navigation à vapeur commença à amener les pèlerins à Djeddah. Depuis lors *la Mecque devint la station de relai du choléra entre le Bengale et l'Égypte* (HART, cité p. 125).

On nous parle souvent des bienfaits de la rapidité des communications. Il serait sot de les nier, mais plus sot encore d'oublier leur caractère tout relatif. D'ailleurs qu'importe la rapidité du point de vue des idées éternelles ? Et puis ce « progrès » a été payé par de vraies hécatombes humaines, et pas seulement humaines, car d'innombrables plantes et d'innombrables animaux ont été détruits et le sont encore par l'introduction soudaine d'ennemis nouveaux. A cet égard l'histoire du monde peut être divisée en deux périodes, qu'on pourrait

(1) Voir divers tableaux cités par l'auteur, par ex. celui de la p. 26 « Mouvement comparé des pèlerins arrivés par voie de mer au Hedjaz ». Total en 1930, 84,821 pèlerins appartenant à plus de 48 nations, auxquels il faut ajouter ceux venant par voie de terre, et ceux qui vivent près des lieux saints.

appeler d'une part la période « moderne » qui mesure moins d'un siècle et que nos souvenirs familiaux nous permettent d'embrasser tout entière, et d'autre part, la période « ancienne », c'est-à-dire, tout le reste du passé. Pendant la période « ancienne » un équilibre biologique s'était lentement établi en chaque lieu; cet équilibre n'était pas final, loin de là, mais il ne changeait pas souvent et pas beaucoup. Depuis que les machines à vapeur et électriques ont bouleversé la face de la terre, cet équilibre est constamment menacé par la brusque mise en contact d'êtres vivants qui n'auraient eu aucune chance de se rencontrer dans le passé.

Mais revenons à nos moutons, les braves ḥawājj — leurs migrations annuelles ont couté tant de vies, que le Pèlerinage a toujours été indirectement un immense sacrifice humain. On estime que « jusqu'en 1902, *en dehors de toute épidémie*, 25 % des pèlerins disparaissaient au cours de leur voyage, dont 20 % mouraient. En période d'épidémies, la proportion des pertes atteignait 40 %. En 1891, sur 46,000 pèlerins, 21.000 ne sont pas revenus » (p. 32). Et le Dr. DUGUET ajoute: « l'histoire des pèlerinages musulmans n'a été le plus souvent qu'un long martyrologe » (2).

Il nous décrit brièvement tous les pèlerinages du point de vue médical, et nous donne parfois assez de détails pour que nous puissions apprécier toute l'horreur de ces grands mouvements de foi et d'abandon généreux transformés par l'implacable destin en calamités. Les pèlerinages les plus terribles furent ceux de 1865 et de 1893. Celui de 1865 « est le modèle type de la propagation et de la généralisation foudroyante du choléra ». Il fut introduit à la Mecque par des Javanais et bientôt il envahit toute l'Europe. Cette épidémie ne devrait s'éteindre qu'en 1874. Elle causa la réunion de la Conférence Sanitaire de Constantinople en 1866 — date capitale, car pour la première fois dans l'histoire du monde, une défense collective et raisonnée était ainsi organisée. Le pèlerinage de 1893 « fut le pèlerinage de l'épouvante ». L'histoire en est bien connue car beaucoup de témoins médicaux nous en ont laissé des souvenirs détaillés. A ces horribles souvenirs se mêlent l'hommage à un homme de cœur, le général turc OSMAN pacha, commandant du Hedjaz; il fit preuve du plus grand courage à Mouna qui fut pour lui le champ d'honneur (p. 159).

Les conditions sanitaires existant à Djeddah, à la Mecque et à Mouna — de mémoire d'homme — étaient vraiment ignobles, indescriptibles (e. g., p. 215). Si l'on tient compte des conditions sociales et économiques — l'entassement soudain d'immenses populations dans des milieux pauvres et arriérés — certaines de ces horreurs étaient inévitables, mais

(2) « Martyrologe » est le mot juste, car du point de vue musulman ceux qui meurent pendant le pèlerinage sont vraiment des martyrs (shuhadā').

rien ne saurait justifier les gouvernements turcs qui empêchèrent les étrangers d'établir au Hedjaz leurs propres hôpitaux et leurs propres services sanitaires à leur propres frais. Mais saura-t-on jamais évaluer tous les crimes dûs au fanatisme religieux et à l'ignorance?

A la triste histoire des épidémies se mêle parallèlement une histoire plus réconfortante, celle des efforts continuels faits par les médecins pour prévenir les dangers d'épidémie, ou les localiser et les restreindre. Le Dr. DUGUET nous raconte simplement, mais avec une singulière autorité, l'histoire des conférences et des organisations sanitaires internationales : une des plus belles pages de l'histoire de l'humanité. Le contraste entre l'inactivité prétentieuse du Conseil supérieur de santé de Constantinople et la belle activité du Conseil sanitaire d'Égypte est saisissant — mais il ne faut pas oublier que la vieille Turquie était bien malade, et quant à l'Égypte, c'était en réalité l'Europe.

Il serait fort intéressant d'ajouter à ces deux histoires, une troisième entrelacée aux deux autres, — c'est-à-dire l'histoire du progrès de nos connaissances sur le choléra et la peste. Le Dr. DUGUET n'a fait qu'effleurer ce troisième côté de la question. Deux jalons fondamentaux sont la découverte du vibrion cholérique par ROBERT KOCH en 1883 (publ. 1884), et du microbe de la peste bubonique par SHIBASABURO KITASATO et ALEXANDRE YERSIN en 1894; un autre c'est la découverte de l'existence de « porteurs de germes », mais je ne puis en préciser la date (3).

Peut on imaginer un contraste plus profond que celui que nous offrent d'une part les foules musulmanes se dirigeant vers la Mecque poussées par un devoir religieux pareil dans son intensité et son inconscience à une force biologique, et d'autre part une petite élite de savants qui se dévoue à la défense médicale de l'humanité mise en péril par les mouvements de ces foules passionnées et inconscientes? Quel contraste entre ces deux devoirs : le devoir religieux et le devoir scientifique, — et j'aimerais à vous demander : lequel des deux est le plus religieux? mais cela nous mènerait trop loin.

Espérons de tout cœur que IBN SÉOUD et les Wahabites qui sont maintenant les maîtres des deux villes sacrées sauront joindre leur efforts

(3) « Au cours de recherches systématiques entreprises en mars 1905 à Tor, sur 55 cadavres morts pour une autre cause que le choléra, le Dr. RUFFER, président du Conseil Quarantenaire d'Égypte, trouve vingt-deux fois le vibrion cholérique, dont deux cas agglutinants, c'est-à-dire présentant ' tous les caractères biologiques de vraies cultures de choléra.' Une découverte analogue avait été faite en 1897. On se trouvait en présence de cette catégorie de gens, à la fois bien portants et dangereux, que représentent les ' porteurs de germes,' et qui, à cette époque, déjà étaient considérés comme jouant un rôle important dans la propagation du choléra. » (p. 206).

à ceux des autres pays du monde pour se défendre contre le choléra et la peste (4). Jusqu'ici la sécurité sanitaire du Hedjaz a été due presque uniquement aux efforts étrangers, mais les progrès de l'automobilisme et de l'aviation viennent d'introduire de nouvelles difficultés qui rendent de plus en plus indispensable la collaboration du Hedjaz à sa propre défense. Je sais qu'une règlementation sanitaire y a déjà été promulguée, mais en Orient encore plus qu'ailleurs, les règlements ne suffisent pas; ce qui importe, c'est leur application. Espérons que le Hedjaz prouvera sa propre civilisation au reste du monde en purifiant le Pèlerinage au point de vue médical comme il l'a déjà fait au point de vue moral.

GEORGE SARTON.

Herbert Thoms.—*Chapters in American Obstetrics.* x+90 pp., 10 illus., CHARLES C. THOMAS, Springfield, Ill., 1933. $ 2.00.

Obstetrics in a rational or scientific sense was impeded in its development in English-speaking lands by two ethico-religious factors, objection to male practice and to the relief of pain in childbirth. Dr. THOMS' brilliant and brief biographical survey of American obstetrics indicates the personal influences in this country which successfully removed these prejudices and permitted the development of the specialty. The transition from midwives to male obstetricians was brought about by the public confidence in such physicians as JOHN MOULTRIE who practiced in 1733 in South Carolina, WILLIAM SHIPPEN (1736-1808) who first taught obstetrics in 1762 in Philadelphia, and JAMES LLOYD (1728-1810) of Boston. Credit for the introduction of anesthesia into obstetrical practice in America should go to WALTER CHANNING (1786-1876), the distinguished teacher of obstetrics at Harvard. In the face of strong objections, even from the profession, he succeeded in showing the value of anesthetic efforts in childbirth, as first advocated by him in 1848. He was also the first to described hemolytic anemia of pregnancy (*Notes on Anhaemia*, 1842).

Dr. THOMS offers several delightful biographical sketches of leaders in American obstetrics. The first text on the subject was written by SAMUEL BARD (1742-1821), one of New York's most influential medical teachers and practitioners. The work was a sound and helpful one. One of Dr. THOMS' most interesting chapters deals with JOHN STEARNS (1770-1848) of New York, who introduced ergot into obstetrical practice, on the basis of experimentation and critical clinical trial (*N. Y. Med. Rep.*, 1807; *Med. Rec.*, 1822). A brief but lucid account is given of

(4) En effet la peste est aussi apparue en Arabie; et contrairement à l'opinion courante elle s'y est même associée au choléra, notamment en 1908 (p. 211).

OLIVER WENDELL HOLMES (1809-1894) and his genius in recognizing and discussing the contagiousness of puerperal fever (*U. S. Quart. Journ. Med. and Surg.*, 1:503, 1843). Another interesting chapter concerns MARMADUKE B. WRIGHT (1803-1879), a pioneer Ohio obstetrician and teacher who gave the classic description of cephalic version (*Proc. Ohio State Med. Soc.*, 1854).

Dr. THOMS deserves congratulations for a charming and valuable contribution to the local history of an important medical specialty. The publisher is to be commended for the beautiful manner in which it is presented.

C. D. LEAKE.

William Allen Pusey.—*The History of Dermatology*. XVII+233 pp., 32 illus., CHARLES C. THOMAS, Springfield, Ill., 1933. $ 3.00.

Though one of the most ancient of medical specialties, dermatology still remains largely in the empirical stage of scientific development. It is amazing that so little apart from its morphology is known of the skin scientifically. Although it is one of the largest organs of the body, easily accessible for study, and obviously involved in a myriad of important bodily functions from allergy and immunity to temperature regulation and water metabolism, the physiology of the skin, upon which the specialty of dermatology must rest, is almost unknown. Dr. PUSEY's interesting book, the first history of dermatology in English, may help to attract biologists more generally to a serious study of the problems offered in the field, for the volume will undoubtedly have a wider appeal than to those concerned merely with the specialty of which it treats.

Dr. PUSEY treats his subject chronologically, and appends a useful " historical index " made up chiefly of references to original descriptions of, or important contributions to, particular clinical dermatological conditions. The number of such " clinical entities " is astonishing. In many of these ignorance obviously hides behind an imposing name.

All the great classical medical writers devoted much attention to skin diseases. JEAN ASTRUC (1684-1766) " should be regarded as the founder of modern dermatology, for he not only pointed the way by studying the histology of the skin, but he first indicated the pathology of certain affections in the light of that knowledge." DANIEL TURNER (1667-1740) who received *in absentia* the first medical degree conferred in the United States (Yale, 1723), was the first great English dermatologist. JOSEPH PLENCK (1732-1807) of Vienna and ANTOINE CHARLES LORRY (1726-1783) of Paris began the systematic classification of skin diseases, which was soundly established by ROBERT WILLAN (1757-1812) and THOMAS BATEMAN (1778-1821). The descriptive period of

dermatology was rounded out by the French school at St. Louis Hospital, Paris, under ALIBERT (1768-1837), BIETT (1781-1840), RAYER (1793-1867), GIBERT (1797-1866), and BAZIN (1807-1878). A new phase in the specialty came with the demonstration of skin diseases caused by micro-organisms as shown by SCHÖNLEIN (1790-1864) and GRUBY (1810-1898). The most influential dermatologist of the period was FERDINAND HEBRA (1816-1880) of Vienna who placed skin pathology on a scientific basis. The most important contribution of Scandinavian dermatology was the discovery in 1871 of the leprosy bacillus by G. A. HANSEN (1841-1912). Outstanding among 19th century English dermatologists were the philanthropic Sir ERASMUS WILSON (1809-1884) and TILBURY FOX (1836-1879). The " strongest force in shaping the early course of American dermatology " was J. C. WHITE (1833-1916). More recent leaders in the field include A. NEISSER (1854-1916), P. G. UNNA (1850-1929) and N. R. FINSEN (1860-1904).

While Dr. PUSEY acknowledges his debt to various medical historians, and particularly to the German historians of dermatology, BLOCH and RICHTER, his contribution is original and scholarly. Wisely he avoids going into detail in the history of syphilis, although this disease usually is handled by the dermatologists. The volume is handsomely put up, and the illustrations are excellent.

C. D. LEAKE.

Thirty-Eighth Critical Bibliography

of the

History and Philosophy of Science and of the History of Civilization

(to March 1933,—with special reference to the seventeenth and eighteenth centuries)

This thirty-eighth Bibliography contains about 665 items of which 251 deal with the seventeenth and eighteenth centuries. They have been kindly contributed by the following fourteen scholars belonging to five different countries :

R. C. ARCHIBALD (Providence, R. I.)
F. M. FELDHAUS (Berlin)
L. GUINET (Brussels)
C. A. KOFOID (Berkeley, Cal.)
H. P. LATTIN (Columbus, O.)
C. D. LEAKE (San Francisco)
A. N. MELDRUM (Bombay)
J. PELSENEER (Brussels)
A. POGO (Cambridge, Mass.)
L. SAPIN (Brussels)
G. SARTON (Cambridge, Mass.)
H. R. VIETS (Boston, Mass.)
K. VOGEL (Munich)
G. WINDRED (Bedford, England).

The Bibliography includes as usual a series of addenda and errata to SARTON's *Introduction to the History of Science*, vols. 1 and 2 (Baltimore and London, 1927 and 1931).

Papers and books sent to the Editor are entered in this bibliography if they are relevant to its purpose. They may be the object of analytical notes or longer reviews, if this seems sufficiently necessary and the services of competent scholars are available. It is obvious that only a small number of publications can be adequately reviewed and that it is not even possible to give a brief description of each and every one. However, our classification is so comprehensive and so minute, that even if we do nothing but give the accurate title of an item and put it in its proper place, we are already rendering a real service to the author, the publisher and the learned public. There is no relation between the importance of a publication and the length of the note devoted to it.

Readers of this Bibliography have complained because some items known to them had not appeared in it or appeared only after too long

a delay. The best way to answer that criticism is to explain how this Bibliography is compiled. The Editor's original ambition was to publish only items which he had been able to check upon the original documents with his own eyes. However, while many irrelevant papers are sent to him (1), some of the most relevant and most important ones fail to reach him. If in his turn he fails to record these publications promptly enough, who should bear the blame for this failure? Surely not he. Should the blame not fall rather upon the author or the publisher? The Editor cannot be expected to register publications which he has not been able to see. Yet even in such cases he tries to fill the gaps of the Bibliography either by reference to other libraries, or by the insertion of items based on reviews published in other journals.

The current practice of *Isis* is as follows : A number of scientific journals are read by the Editor and his associates and notes relative to the relevant material are typed. The notes relative to original articles are included at once ; on the contrary, the secondhand notes (i.e., those based on reviews) can be admitted only after some kind of confirmation (e.g., by means of another review) has been obtained, and thus their insertion may be delayed considerably.

There has gradually accumulated in the editorial drawers such a quantity of notes awaiting confirmation, that some means must be found of reducing it. Henceforth, we shall try to dispose of a package of them—relative to this or that period or this or that topic—in every Critical Bibliography. For example, in the present one, we liquidated as much as we could of our stock of notes concerning the seventeenth and eighteenth centuries.

Notes sent in by contributors cannot be checked by the Editor upon the originals ; hence these contributors are responsible for them.

In conclusion, instead of blaming the Editor, authors and publishers should send their books and papers to him more promptly.

Some authors labor under the extraordinary delusion that they cannot be expected to send their publications except in exchange for the Editor's own books. To begin with how could this be possible? The Editor's *Introduction* is a very large, and hence an expensive, work. Thanks to the liberality of the Carnegie Institution, he was able to distribute it to all the scholars who had helped him, but how could he distribute it also to the thousands of scholars whose publications are reviewed and registered in *Isis?* The whole edition of the *Introduction* would

(1) These, by the way, he cannot undertake to return as it would involve too much labor. The Editor's usual practice is to present all irrelevant materials to the Widener Library.

be insufficient for such a purpose. Moreover, when authors send their books to the Editor, they give nothing to him personally, for he must naturally surrender these books to the reviewers.

When relevant publications are sent to the Editor, they are reviewed or registered in *Isis*, and that review or registration completes the exchange.

The ultimate aims of this undertaking are: (1) to establish the History of Science as an independent discipline; (2) to demonstrate inductively the Unity of Knowledge and the Unity of Mankind; (3) to serve as a center of information and rallying ground to the scholars engaged in our studies.

Harvard Library, Room 185 GEORGE SARTON.
Cambridge, Massachusetts. *April* 21, 1933.

N. B. The Critical Bibliographies, nos. 32 to 36, edited during my absence in the Near East contain many irregularities; the classification of items is sometimes erratic. I beg the students using our bibliographies —especially these five—to read not only the sections which interest them most but others as well. G. S.

PART I

FUNDAMENTAL CLASSIFICATION (CENTURIAL)

VIth Century B.C.

Codellas, Pan. S. ALCMAEON OF CROTON: his life, work, and fragments. *Proceedings of the Royal Society of Medicine*, 25, 1041-46, London, 1932. ISIS

ALCMAEON OF CROTON's book is lost; only a few fragments of his writings have remained (SARTON: *Introduction to the Hist. of Sci.*, vol. 1, p. 77). CODELLAS lists these fragments and gives in full those having medical interest. The majority consist of references to the writings of ALCMAEON by other writers, carefully documented. The important papers on ALCMAEON form a critical bibliography at the end of CODELLAS' paper. H. R. V.

Keith, A. Berriedale. The doctrine of BUDDHA. *Bull. of the School of Oriental Studies*, 6, 393-404, 1931. ISIS

"The picture we can form of the doctrines of the BUDDHA himself must be conjectural and uncertain, but it has the merit of being in accord with the probability that his doctrines were far removed from the refinements of the scholastic philosophy as preserved in the Pāli Canon, which presents the appearance of being the product of much discussion by contending schools whose existence tradition emphatically asserts."

Stcherbatsky, Th. The doctrine of the BUDDHA. *Bull. of the School of Oriental Studies*, 6, 867-96, 1932. ISIS

Sharp criticism of KEITH's paper, *ibidem*, p. 393-404. G. S.

Suali, Luigi. L'Illuminé. La légende du BOUDDHA. Traduit de l'Italien par PAUL EMILE DUMONT. 352 p. Paris, DENOËL et STEELE, 1933. ISIS

Vth Century B.C.

Bernard, Léon. Une " Vie d'Hippocrate." *Revue scientifique*, 70, 178-81, 1932. ISIS

A propos du livre récent de G. BAISSETTE : *Hippocrate.* BERNARD GRASSET, Paris, 1931.

Castiglioni, Arturo. L'orientamento neoippocratico del pensiero medico contemporaneo. 51 p. Reprinted with additions from *Minerva medica*, Torino, May 5, 1932. ISIS

" All'insegnamento di IPPOCRATE è tornato il pensiero medico in tutte le epoche di decisivo progresso, come reazione ad ogni forma di dogmatismo scolastico irrigidito in un sistema : in Alessandria esso ha determinato il massimo splendore delle ricerche fisiologiche, nel Rinascimento italiano fu contemporaneo al ritorno allo studio della natura e all'ispirazione dell'arte classica : auspice del rinnovamento della clinica in Italia col BAGLIVI, in Inghilterra col SYDENHAM, in Olanda col BOERHAAVE. Nell'epoca nostra questra rinascita si afferma come reazione all'indirizzo morfologico positivista e dogmatico; o forse per essere più esatti si potrebbe dire che ne indica il temperamento."

Delatte, A. Les harmonies dans l'embryologie hippocratique. *Mélanges Paul Thomas*, p. 160-71, Bruges, 1930. ISIS

« L'un des traités hippocratiques les plus riches de substance et les plus intéressants pour la reconstitution de la philosophie présocratique est, sans conteste, le premier livre de l'ouvrage sur le Régime (*περὶ διαίτης, de victu*). Utilisé depuis longtemps, à cause des théories héraclitiques dont il est gros, pour l'enrichissement de notre compréhension de l'*Obscur* penseur, il a révélé, après les études de FREDRICH et de HEIDEL, une foule de parallèles avec d'autres systèmes philosophiques du VI^e^ et du V^e^ siècles. »

« L'étude des théories de l'accordement de l'embryologie hippocratique nous mène encore à une autre conclusion : c'est qu'on peut considérer les doctrines pythagoriciennes dont nous avons tiré les éclaircissements nécessaires, et qui ne nous sont connues que par des témoignages tardifs, comme appartenant à l'ancien pythagorisme. On ne peut penser, en effet, que les Pythagoriciens postérieurs se soient inspirés des œuvres hippocratiques; dans celles-ci la doctrine est obscure et d'ailleurs l'auteur du *De semptim. partu* invoque une autorité étrangère. D'autre part, les spéculations arithmétiques et harmoniques sont propres au pythagorisme ainsi que l'habitude de transférer

les lois de ces sciences dans les autres domaines de l'étude de la nature. Il est donc fort vraisemblable que nous avons découvert dans les ouvrages hippocratiques une nouvelle trace d'influence de l'École de médecine italique. »

Stein, Otto. Die Wundervölker Indiens bei SKYLAX. *Swobodas Epitymbion*, p. 311-19, 1927. ISIS

Temkin, Oswei. Views on epilepsy in the Hippocratic period. *Bulletin of the Institute of the History of Medicine*, The Johns Hopkins University, 1, 41-44, 1933. ISIS

IVth Century B.C. (whole and first half)

Becker, O. Die diairetische Erzeugung der platonischen Idealzahlen. *Quellen und Stud. Gesch. Math.*, B. 1, 464-501, 1931. ISIS

Handelt von der noch ungelösten Frage : Was sind die Platonischen Idealzahlen und wie werden sie erzeugt? B. denkt sich die Entstehung z. B. der idealen Zwei aus der Eins durch dyadische Unterteilung und der idealen Vier aus der Zwei, so dass schliesslich die Tetras aus vier Einheiten (genauer : Untereinheiten = 1/4 der ersten Einheit) besteht. Diese Einheiten entsprechen dann den Ideen der Eidekette. Was hierüber sowie über die damit zusammenhängende dyadische Bruchrechnung und ihre geometrische Darstellung gesagt wird, leuchtet ein. Anders steht es mit der Erklärung der ungeraden Idealzahlen. Wie sollen z.B. die unhomogenen Teilungen „Geflügelt, zweifüssig, vierfüssig" im Schema der Lebewesen eine zusammengehörende Trias bilden? Auf den letzten 18 Seiten zahlreiche Belege aus PLATON und ARISTOTELES. K. V.

Fritz, K. von. PLATON, THEÄTET und die antike Mathematik. *Philologus*, 87, 40-62, 136-78, 1932. ISIS

Wendet sich gegen die Ansicht, dass erst unter dem Einfluss PLATOS eine wirkliche Beweismethode geschaffen und die Axiome herausgearbeitet wurden; F. zeigt, dass man so den vorplatonischen Mathematikern, insbesondere HIPPOKRATES nicht gerecht wird. K. V.

Jones, Roger Miller. Incommensurable numbers and the Epinomis. *Amer. Journ. Philol.*, 53, 61-66, 1932. ISIS

Shorey, Paul. Les idées de PLATON et l'évolution d'ARISTOTE. Une esquisse. *Mélanges Paul Thomas*, p. 633-49, Bruges, 1930. ISIS

IVth Century B.C. (second half)

Mieli, Aldo. Aristote savant. *Archeion*, 14, 169-82, 1932. ISIS

Article destiné à un dictionnaire d'histoire de la philosophie et des sciences, que doit publier la section de synthèse générale du Centre international de synthèse, d'accord avec la section d'histoire des sciences de ce même

centre. Il est suivi d'un appendice dans lequel MIELI oppose, touchant ARISTOTE, le point de vue du savant, du naturaliste, à celui du philosophe. Celui-ci minimise ARISTOTE, par rapport à PLATON; pour celui-là au contraire, la science d'ARISTOTE « c'est-à-dire l'étude pratique des faits naturels et la recherche de leur coordination dans un système organique, représente le mieux qu'ait pu accomplir la science antique, et se rapproche le plus des fondements qui guident le chercheur de nos temps ». L. G.

Il est fâcheux que cet article qui est censé servir de modèle soit aussi incomplet. Pour ce qui concerne la biologie, l'auteur a surtout insisté sur les théories, il aurait valu la peine d'indiquer des faits concrets qui seuls peuvent prouver la valeur *scientifique* de l'œuvre d'ARISTOTE. G. S.

Ritter, Wm. E. Why ARISTOTLE invented the word *entelecheia*. *Quarterly Review of Biology*, 7, 377-404, 1932. ISIS

Stephanides, Michael. ARISTOTELES als Naturforscher. *Archiv für Geschichte der Philosophie*, 41, 363-67, 1932. ISIS

" Im allgemeinen tadelt man die griechische Wissenschaft, dass sie ihre Forschung auf Theorien und Hypothesen gründete, die sich nicht durch Beobachtung rechtfertigten, oder dass sie einen Schluss aus ärmlichen Beobachtungen zu ziehen sich beeilte. Dieser Tadel, wenn er auch aus einer Vergleichung mit der neueren Wissenschaft hervorgeht, entspricht doch einer Wahrheit. Es ist aber keineswegs wahr, dass ARISTOTELES auch denselben Tadel verdient, und wir können nicht annehmen, was man gewöhnlich behauptet, dass ARISTOTELES nicht treulich seiner epagogischen Methode gefolgt ist. Im Gegenteil können wir ARISTOTELES wegen einer fanatischen Anhänglichkeit an die Beobachtung und wegen einer fortgesetzten Beschränkung der logischen Forschung auf die Grenzen der physischen Wirklichkeit tadeln".

Tkatsch, Jaroslaus (gest. Nov. 4, 1927). Die arabische Übersetzung der Poetik des ARISTOTELES und die Grundlage der Kritik des griechischen Textes. (*Akademie d. W. in Wien*, Kommission für die Herausgabe der arabischen ARISTOTELES-Übersetzungen, I). Quarto. Bd. 1, 283 S.; Bd. 2, Aus dem Nachlass hrsg. v. A. GUDEMAN und TH. SEIF, VI+237 S., Wien, HÖLDER-PICHLER-TEMPSKY, 1928-32. ISIS

Very elaborate study on the Syriac and Arabic traditions of the Poetics. Followed by a critical edition of the Arabic text together with a Latin version and abundant notes. Though historians of science are not specially concerned with the Poetics, they should take this study into account for the understanding of the transmission of Aristotelianism from the Greek world to the Syriac and Arabic worlds. G. S.

IIIrd Century B.C. (whole and first half)

(Euclid). Gli elementi d'EUCLIDE e la critica antica e moderna. Editi da FEDERIGO ENRIQUES col concorso di diversi collaboratori. Libro X,

traduzione di MARIA TERESA ZAPELLONI, note di RUTH STRUIK. 355 p. (Per la storia e la filosofia delle matematiche, 10). Bologna, ZANICHELLI, 1932 (L. 30). ISIS

We welcome the continuation of the Italian translation of EUCLID's Elements and commentary upon them edited by FEDERIGO ENRIQUES. The present volume contains the difficult Book X dealing with irrationals. Mrs. RUTH STRUIK has contributed a number of short notes and a longer one devoted to the solution of cubic equations. G. S.

IIIrd Century B.C. (second half)

Müller, Conrad. Wie fand ARCHIMEDES die von ihm gegebenen Näherungswerte von $\sqrt{3}$? *Quellen und Studien zur Geschichte der Mathematik, Astronomie, und Physik*, Abtg. B : Studien, 2, 281-85, 1932. ISIS

Neugebauer, O. APOLLONIUS-Studien. (Studien zur Geschichte der antiken Algebra II.). *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik*, Abtg. B : Studien, 2, 215-54, 47 fig., 1932. ISIS

1. Allgemeine Voraussetzungen; 2. Die Mittelpunktsgleichung; 3. Der Parabelbrennpunkt; 4. Verallgemeinertes geometrisches Mittel; Anhang.

Rome, A. Notes sur les passages des catoptriques d'ARCHIMÈDE conservés par THÉON D'ALEXANDRIE. *Ann. soc. sc.* Bruxelles, 52, 30-41, 1932. ISIS

Sidersky, D. Une éclipse de soleil au temps d'AÇOKA. *Journal asiatique*, 220, 295-97, 1932. ISIS

Toeplitz, O. Bemerkungen zu der vorstehenden Arbeit von CONRAD MÜLLER. *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik*, Abtg. B : Studien, 2, 286-90, 1932. ISIS

Apropos of C. MÜLLER, Wie fand ARCHIMEDES die von ihm gegebenen Näherungswerte von $\sqrt{3}$? *Ibid.*, 2, 281-85, 1932.

Ist Century B.C. (whole and first half)

Goethals, Em. Le sentiment de la nature chez LUCRÈCE. *Mélanges Paul Thomas*, p. 359-63, Bruges, 1930. ISIS

« La conception matérialiste des choses, qui paraît si dénuée de beauté, a produit chez LUCRÈCE un jaillissement ininterrompu de haute poésie, et lui a fait créer la plus belle personnification de la littérature latine : La Nature. » « C'est cette conception très poétique qui est la source même de son inspiration, et qui a donné au poème sa richesse inépuisable, et ses résonnances profondes. C'est elle qui a donné au poète la force de convertir la sèche théorie atomiste

en une poésie vivante des choses, qui a donné au poème l'allure grandiose d'une épopée, et a fait du *De Rerum Natura*, l'apothéose de la Vie de l'univers. »

Rehm, Albert. Der römische Bauernkalender und der Kalender CAESARS. *Swobodas Epitymbion*, p. 214-28, 1927. ISIS

„Die Untersuchung hat ergeben, dass sich der neue Kalender als ein Kompromiss herausstellt, bei dem der Astronom schlecht abschnitt und ein für ihn ganz unharmonisches Gebilde zustande kam. Aber der julianische Kalender ist nicht das einzige solche Miss- und Mischgeschöpf von wunderbarer Lebenskraft. Vielleicht ist es gerade ein Beweis der Genialität so etwas hinstellen zu können. MOMMSEN hat ganz recht, wenn er sagt: ' Im ganzen genommen haben wenige legislatorische Reformen so vollständig ihren Zweck erreicht, wie die caesarische des Kalenders "'.

Ist Century B.C. (second half)

Galbiati, Iohannes. OVIDII de piscibus et GRATII de venatione fragmenta Ambrosiana. *Raccolta in onore di F. Ramorino*, 575-80, 1927. ISIS

Goetz, Georg. VARRO de Re Rustica in indirekter Überlieferung. *Judeich Festschrift*, p. 45-67, Weimar, 1929. ISIS

Scalais, R. L'éloge de l'Italie par VARRON. *Mélanges Paul Thomas*, 618-26, Bruges, 1930. ISIS

« Malgré certaines exagérations que renferme l'éloge de l'Italie par VARRON et qu'on peut mettre au compte de l'art oratoire, nous pensons que cet écrivain, soucieux d'éviter les anachronismes et attentif aux réalités, donne un tableau assez juste de la situation agricole de l'Italie. »

Ist Century (whole and first half)

Robbins, Frank Egleston. Arithmetic in PHILO JUDAEUS. *Class. Philol.* 26, 345-61, 1931. ISIS

Staehle, Karl. Die Zahlenmystik bei PHILON VON ALEXANDRIA. VI+92 p., Leipzig, TEUBNER, 1931. ISIS

Ist Century (second half)

Ginsburg, Jekuthiel. JACOB B. MACHIR's version of MENELAUS's work on spherical trigonometry. Translated and edited by JEKUTHIEL GINSBURG. *Scripta mathematica*, 1, 153-55, 1932. ISIS

Trotzki, J. Studien zur Überlieferungsgeschichte COLUMELLAS. *Raccolta in onore di F. Ramorino*, 449-72, 1927. ISIS

IInd Century (whole and first half)

Herrmann, Albert. MARINUS VON TYRUS. *Petermanns geographische Mitteilungen*, Ergänzungsheft 209, p. 45-54, Gotha, 1930. ISIS

Wiegand, Theodor. Zweiter Bericht über die Ausgrabungen in Pergamon 1928-32 : Das Asklepieion. Mit 1 Plan, 10 Tafeln, 18 Abbildungen im Text und epigraphisch-historischem Beitrag von W. WEBER. 95 p. (Aus den *Abhandlungen der preussischen Akademie der Wissenschaften*, Jahrgang 1932, phil.-hist. Klasse, Nr. 5). Berlin, 1932. (Rm. 21.50). ISIS

The excavation of the Asclepieion of Pergamon is of deep interest to the historian of Greek medicine. That architectural ensemble of the second century of our era was magnificently planned out. It included many buildings, which it is now possible to visualize in their original splendor at least with the mind's eye : the Propylon of CLAUDIUS CHARAX and its forecourt, a hall dedicated to HADRIAN (emperor from 117 to 138), the round temple of ASCLEPIOS SOTER with a very remarkable substructure, a tunnel, a theatre, etc. Remains of earlier constructions, probably of the old Asclepieion destroyed by PRUSIAS II in 156 B.C., have been found on the site. The Propylon was constructed during the rule of ANTONINE THE PIOUS (138 to 161); the whole group of buildings was already completed in 146. The report gives all the available information on the buildings and on the inscriptions (most of these of the second century). The main inscription is the subject of an elaborate study by WILHELM WEBER : Zu der Inschrift des IULIUS QUADRATUS (p. 57-95),—however this does not concern the history of science. G. S.

IInd Century (second half)

Gnirs, Anton. Zum kartographischen Beiwerk in der Bilderchronik der Marcus-Säule. *Swobodas Epitymbion*, p. 28-40, 6 fig., 1927. ISIS

Tudeer, Lauri O. Th. Some maps attached to PTOLEMY's geography. HEIKEL, *Commentationes philologicae in honorem*, p. 154-63, Helsinki, 1926. ISIS

Vari, Rodolfo. Quid affinitatis OPPIANI Halieuticorum codices nonnulli habeant, quaeritur. *Raccolta in onore di F. Ramorino*, 439-46, 1927. ISIS

Supplement to the note published in *Isis*, 11, 413.

IIIrd Century (second half)

Hee, L. van. Le classique de l'île maritime, ouvrage chinois du III[e] siècle. *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik*, Abtg. B : Studien, 2, 255-80, 9 fig., 1932. ISIS

Apropos of the Hai-tao suan-ching of LIU HUI (see my *Introduction*, 1, 338). « Pour permettre au lecteur général de mieux se rendre compte de la valeur de cet opuscule célèbre, nous donnerons d'abord un tableau général des mathématiciens chinois, afin de mettre l'auteur dans son milieu; puis, après avoir indiqué la valeur des mesures en usage aux bords des Fleuves Bleu et Jaune, nous examinerons l'origine et l'authenticité de l'œuvre. La traduction annotée suivra. Neuf dessins permettront de saisir les données des neuf problèmes. Enfin des formules à la moderne montreront, non pas la méthode théorique, mais les opérations pratiquement exécutées ».

Revelli, Paolo. Figurazioni cartografiche dell' età imperiale in un codice ambrosiano di SOLINO del primo trecento. *Raccolta in onore di F. Ramorino*, 615-26, 1 pl., 1927. ISIS

« La cosmografia soliniana non deriva direttamente da PLINIO, ma da una fonte — che noi potremmo chiamare cosmografia varro-sallustiana, a cui dovette attingere lo stesso autore dell' *Historia naturalis*. E risorge un'altra domanda : quando è vissuto SOLINO ? »

Ver Eecke, P. Le théorème dit de GULDIN considéré au point de vue historique. *Mathesis*, 46, 395-97, 1932. ISIS

Since VER EECKE is the author of various French translations of Greek authors, one might naturally suppose that his categorical statements concerning Greek mathematical works might be accepted as authoritative. This article proves that the reverse is the case. The two principal statements concerning PAPPUS are without the slightest foundation in fact. Hence the article is worthless and can only do harm by imposing on those not in a position to check the statements. The first published edition of the *Collection* of PAPPUS was the Latin translation of COMMANDINUS (Venice, 1589, but dated at the end " Pisauri apud Hieronymum Concordiam 1588 "). VER EECKE's main argument is based on the statement that the essence of " Guldin's " theorem is not to be found in this edition. Yet it is given on folio 163b. Again VER EECKE states that the *Collection* " ne présente aucune trace de ce problème " : " Par un point pris sur la bissectrice d'un angle droit, mener un segment de longueur connue et dont les extrémités soient sur les côtés de l'angle." And yet PAPPUS gave to this problem a special name, " problem of Heraclitus " and discusses the more general problem when the given lines are oblique. See p. 670, *et al.*, of the HULTSCH edition of the *Collection;* also R. C. ARCHIBALD, " Discussion and history of certain geometrical problems of HERACLITUS and APOLLONIUS," *Proc. Edinburgh Math. So.*, v. 28, 1910, p. 157-178 + 4 plates. R. C. A.

IVth Century (second half)

Dignāga. Pramana Samuccaya. Edited and restored into Sanskrit with Vṛitti, Ṭīkā, and notes by H. R. RAMASWAMY IYENGAR. XXIV+110 p. (Mysore University Publication). Mysore, Government Branch Press, 1930. ISIS

Reviewed by J. C., *Bull. of the School of Oriental Studies*, 6, 1033, 1932.

" Just as some works of ARISTOTLE have been lost but were retrieved during the Middle Ages through Arabic translations, several writings of famous Buddhist authors have been preserved to us only in Chinese or Tibetan versions. Such has been the fate of the *Pramāṇa-samuccaya*, a handbook of logic by DIGNĀGA, the fame of which according to MR. RAMASWAMY IYENGAR vies with or even surpasses that of the logical treatises of ARISTOTLE."

Vth Century (whole and first half)

Dussaud, René. Un gnomon syriaque. *Syria*, 9, 80, 1928. ISIS

« La pierre plane que nous reproduisons offre un demi-cercle divisé en douze parties — les douze heures du jour — chacune d'elles étant subdivisée en cinq parties égales, ce qui donne à chacune de ces dernières divisions une valeur théorique de douze minutes. Les grandes divisions sont notées d'abord par les dix premières lettres de l'alphabet syriaque, puis par les ligatures de la dixième avec la première et de la dixième avec la deuxième. D'après l'écriture la date probable de ce monument est le V^e^ siècle de notre ère. »

VIth Century (whole and first half)

Patch, Howard Rollin. Consolatio philosophiae, IV, m. vi, 23-24. *Speculum*, 8, 41-51, 1933. ISIS

" In the sixth poem of Book IV of the *Consolatio* BOETHIUS celebrates again the Love that rules the sun and the other stars. This is one of at least five poems in which he treats of the concord of the universe, a theme expressed in the first line of the hymn that is central in this group ' O qui perpetua mundum ratione gubernas '. "

VIIth Century (whole and first half)

Bergsträsser, Gotthelf. Plan eines Apparatus Criticus zum Koran, 11 p. *Sitzungsberichte der Bayerischen Akademie der Wissenschaften.* philosophisch-historische Abteilung, H. 7, München, 1930. ISIS

FLÜGEL's Qur'ān generally used by western orientalists is very imperfect; —it was already insufficient at the time of its first appearance (1834). The official text published by the Egyptian Government is distinctly superior, and can be obtained more cheaply than FLÜGEL's text, which should be definitively discarded. The Egyptian official text, good as it is, is not yet a scientific edition according to the standards of western criticism. Such an edition is being prepared on the one hand by Prof. JEFFERY of the American University in Cairo, and on the other, by the author. They are working independently but have reached an agreement in order to avoid unnecessary duplication of effort. The author is now organizing a collection of photographs of all the Kufic MSS. of the Qur'ān. G. S.

VIIth Century (second half)

Ruska, Julius. Ein dem CHĀLID IBN JAZĪD zugeschriebenes Verzeichnis

der Propheten, Philosophen und Frauen, die sich mit Alchemie befassten. *Der Islam*, 18, 293-99, 1929. ISIS

VIIIth Century (second half)

Hedfors, Hjalmar. Compositiones ad tingenda musiva, herausgegeben, übersetzt und philologisch erklärt. XVIII+226 p., 1 pl. Uppsala, ALMQVIST & WIKSELLS, 1932. ISIS

New edition of this famous collection of technical recipes preserved in a Lucca Ms. (Cod. Lucensis 490) dating from the end of the eighth or the beginning of the ninth century, and written by various hands. It was first edited by L. A. MURATORI in Milano, 1739, then again by A. PELLIZZARI : I trattati attorno le arti figurative in Italia e nella penisola iberica dall' antichità classica al Rinascimento ed al secolo XVIII (vol. 1, 453-502, Napoli, 1915). I did not know of the second edition when I spoke of that text in my *Introduction* (vol. 1, 533). The *Compositiones ad tingenda* and the *Mappae clavicula* are the earliest representatives of old Hellenistic traditions in the Latin West; they were followed by other comparable treatises : HERACLIUS (second half of the tenth century), *De clarea* (second half of the eleventh century), THEOPHILE THE PRIEST (end of eleventh century). For the *De clarea*, see the paper by DANIEL V. THOMPSON, jr. (1932), reviewed in this bibliography; for the others, see my *Introduction* (vol. 1, 533, 673, 763; vol. 2, 219). The *Compositiones* and the *Mappae clavicula* contain words betraying a Greek origin, and also others betraying a vernacular origin. The *Compositiones* were certainly compiled in Italy, cf. such expressions as secundo quod (secondochè), laxas desiccare (lasci seccare). The editor's main interest is philological. Abundant philological notes. Elaborate bibliography. Numerous indices. G. S.

(Jābir ibn Ḥayyān). The Arabic works of JĀBIR IBN ḤAYYĀN edited with translations into English and critical notes by ERIC JOHN HOLMYARD. Volume 1, part 1 (Arabic texts). Paris, GEUTHNER, 1928. ISIS

Reviewed by PAUL KRAUS, *Der Islam*, 19, 285-89, 1931.

Richter, Gustav. Über das kleine Adabbuch des IBN AL-MUQAFFA'. *Der Islam*, 19, 278-81, 1931. ISIS

IXth Century (whole and first half)

al-Kindī, Ja'qūb ibn Isḥāq. Risāla fīkhubr tā'līf al-alḥān. Über die Komposition der Melodien. Nach der Handschrift Brit. Mus. Or. 2361 mit Übersetzung, Einleitung und Kommentar sowie englischer Einführung hrsg. von ROBERT LACHMANN und MAHMUD EL-HEFNI. 30+XX p., 3 fig. (*Veröffentlichungen der Gesellschaft zur Erforschung der Musik des Orients*, 1). Leipzig, KISTNER & SIEGEL, 1931. ISIS

" The earliest writings on music in Arabic that have come down to us are

those of the philosopher AL-KINDĪ (c. 790-874). One of his treatises (Ms. Berlin, Ahlwardt 5503) deals with rhythm and with the relations between music and the other forces and elements of the universe; extracts of it have been given by H. G. FARMER." Of another treatise, on the composition of melodies we possess only one manuscript (Brit. Mus., Or. 2361) the beginning of which is missing. The text is not divided into chapters, but it is easy to divide it as follows : 1. Fourths, fifths, and octaves on the lute; 2. Number and function of the notes; 3. The modes; 4. The transitions; 5. The composition; 6. Music and prosody; Conclusion.

The treatise is largely an elaboration of Greek knowledge, but the chapter on musical composition—the Greek melopoiia—contains a more detailed description of melodic structures than the extant Greek sources, and of course everything concerning the lute is independent of Greek theory. The lute was " unknown to the Greeks, but was from the rise of Islām, and is now, the chief musical instrument in the towns of the Near East. Arabian theorists, therefore, have always taken great pains to explain the tuning of this instrument and the places of its stops; and the demonstration of the musical system on the finger-board of the lute is an essential feature in their treatises. AL-KINDĪ was, perhaps, the first to undertake this demonstration and the difficulty in applying a foreign system like the systêma teleion to a native instrument may account for some obscurities in his treatise. Unlike his great successor, AL-FĀRĀBĪ, AL-KINDĪ does not inform us about contemporary variants in the tuning and stopping of the strings of the 'ūd, nor about musical systems or usages in pre-Islamic times. Possibly, there is a trace of the so-called ,, courses " (Arab. majārī, sing. majrā) into which early Islamic practice divided its modes. But on the whole, the treatise is exclusively concerned with those data of musical composition which AL-KINDĪ considered as indispensable for contemporary readers." G. S.

IXth Century (second half)

Giles, Lionel. A Chinese geographical text of the ninth century. *Bull. of the School of Oriental Studies*, 6, 825-46, 4 pl., 1932. ISIS

" The STEIN Collection of MSS. from Tun-huang at the British Museum, so rich in other respects, includes very few documents of a purely topographical nature. The two most interesting texts belonging to this class are the *Tun huang lu* (S. 5448), which was published with translation and notes in the *JRAS.* for July, 1914, and the present roll (S. 367), which is unfortunately imperfect at the beginning and lacks a title. The *Tun huang lu* deals with the district immediately surrounding Tun-huang itself, but the other treatise goes farther afield, and follows the ' southern route ' as far as Charchan, after which it doubles back to the oasis of Hami and the neighbouring territory." The date given at the end is equivalent to Feb. 2, 886. G. S.

Malone, Kemp. On King ALFRED's geographical treatise. *Speculum*, 8, 67-78, 1933. ISIS

Contents : 1. Ests and Osti; 2. The identity of the Osti; 3. The Eastfrancan; 4. Ireland.

Xth Century (whole and first half)

Shafi', Muḥammad. A description of the two sanctuaries of Islām by IBN 'ABD RABBIHI (d. 940). A volume of Oriental Studies, presented to EDWARD G. BROWNE, p. 416-38, Cambridge University Press, 1922.

Xth Century (second half)

Lattin, H. P. LUPITUS BARCHINONENSIS. *Speculum*, 7, 58-64, 1932. ISIS

Modi, Sir Jivanji Jamshedji. The Mobadān MOBAD OMĪD IBN ASHAVAST, referred to by HAMZĀ ISPHAHĀNĪ. Who was he? Ehrengabe für WILHELM GEIGER, 1931, p. 274-88. ISIS

XIth Century (whole and first half)

Ḥazm, Ibn. ASÍN PALACIOS, MIGUEL. ABENHÁZAM de Córdoba y su historia crítica de las ideas religiosas. Vol. 5, 383 p. (Academia de la historia). Madrid, Tip. de la Rev. de Archivos, Bibliotecas y Museos, 1932. ISIS

The first volume of this great work published in 1927 was reviewed in *Isis*, 11, 168. It is in the nature of a general introduction; the second (*Isis*, 13, 155) and following (*Isis*, 14, 473) contain the Spanish translation of IBN ḤAZM's magnum opus, the *Fiṣal*—the foremost mediaeval work on the history of religions. The present volume includes the fourth, fifth, and sixth treatises of the *Fiṣal*. Treatise IV deals with the imamate; treatise V with Muslim heresies, or more exactly with the heretical ideas of the various Muslim sects; treatise VI is by far the most interesting from our point of view. We find in it discussions of magic, miracles, jinn, epilepsy, physical forces, prophecy among women, dreams,... numbers, astrology, nature of divine creation, existence, infinity, universals, movement, efficient causality, interpenetrability of bodies, transformation, action at distance and movement per saltum (ṭafrah), man, accidents, substance, soul, atom, knowledge, color, generation of living beings (the whole of this treatise covers 227 p.). We are given here a systematic discussion of the main philosophical problems, and an analysis of it would be welcome in *Isis*.

We pray that Don MIGUEL be granted to continue this very important publication to its end and to add to it the glossaries and indices without which its usefulness and value would be considerably reduced. G. S.

Hefny, Mahmoud el. (1896-). IBN SINA's Musiklehre hauptsächlich an seinem "Najāt" erläutert. Nebst Übersetzung und Herausgabe des Musikabschnittes des "Najāt." Inaugural-Dissertation, Berlin. 100 p. Berlin-Wilmersdorf, HELLWIG, 1931. ISIS

„Wir haben uns bemüht, ein Bild von IBN SINAS Musiklehre zu geben,

und dazu nicht nur sein Najāt in deutscher Übersetzung und korrigiertem Urtext veröffentlicht, sondern auch durch Erklärungen, bei denen ständig sein Shifā herangezogen worden ist, ein möglichst vollständiges Bild hergestellt. Im Kommentar haben wir ferner die bedeutendsten arabischen Musiktheoretiker des Mittelalters herangezogen, sei es zum Zweck der Erklärung, sei es zu Vergleichszwecken. Eine besondere Stellung nehmen hierbei natürlich die ihm zeitlich zunächst stehenden Theoretiker ein, wie AL-FĀRĀBĪ und die Ikhwān al-Ṣafā."

Kraus, Paul. Eine arabische Biographie AVICENNAS. *Klinische Wochenschrift*, 11, 1880-84, 1932. ISIS

Translation of the biography of IBN SĪNĀ composed by his favorite disciple ABŪ 'UBAID AL-JUZJĀNĪ (see *Introduction*, 1, 711), who accompanied his master everywhere for 25 years. This includes IBN SĪNĀ's autobiography (down to the age of 32). The Arabic text is included in the histories of IBN ABĪ UṢAIBI'A and IBN AL-QIFṬĪ. This text has often been used but this is the first complete translation. KRAUS has translated the text given by IBN ABĪ UṢAIBI'A. A very welcome publication. G. S.

Kraus, Paul. Hebräische und syrische Zitate in ismā'īlitischen Schriften. *Der Islam*, 19, 243-63, 1931. ISIS

„Die Zitate stammen alle von einem Autor. AḤMAD B. 'ABDALLĀH ḤAMĪD AD-DĪN AL-KIRMĀNĪ lebte zur Zeit des fāṭimidischen Chalifen AL-ḤĀKIM BI-AMRI-LLĀH (386-411 H.), war ḥujjat al-'irāqain, d.h. Leiter der ismā'ilitischen Propaganda im Osten, und entfaltete daselbst eine reiche literarische Tätigkeit. In seinem späteren Alter (etwa 407 H.) wurde er von AL-ḤĀKIM nach Ägypten berufen, um den dortigen ismā'ilitischen Lehrbetrieb zu reformieren. Kirmānī ist eine der bedeutendsten Erscheinungen innerhalb der fāṭimidischen Ismā'īlīya. In seinen Hauptwerken versuchte er, die ismā'īlitische Lehre zu vertiefen und philosophisch zu begründen. Für die Folgezeit galt er neben den Abhandlungen der Ikhwān aṣ-safā als die wichtigste Autorität und wurde häufig zitiert. Von seinen zahlreichen Werken sind die meisten noch erhalten und befinden sich im Besitze der ismā'ilitischen Organisation in Indien. Ihre Echtheit ist aus inneren Gründen unanfechtbar."

Sedky bey, Mahmoud. Un banquet de médecins au temps de l'Emir NASR EL-DAWLA IBN MARWAN (Daāwat el-Atibba d'IBN BATLANE). 55 p., illus. Cairo, Imprimerie Misr, 1928. ISIS

Incomplete translation of the Da'wat al-aṭibbā, a satirical medical treatise composed by IBN BUṬLĀN in 1058 (*Introduction*, 1, 730). The author does not say which text he used, but it was presumably the edition of Alexandria, 1901, for I know of no other. The introduction is very carelessly written, the dates are wrongly quoted, the illustrations childish. The text itself is very interesting, and would deserve better treatment. SEDKY bey sums it up as follows :

" Écrit dans un style plaisant et burlesque sous lequel l'auteur (médecin lui-même) cherche à masquer sa satire sur les médecins et empiriques de

l'époque, c'est l'histoire d'un aventurier qui a réussi à s'introduire chez un vieux médecin de la ville Mayafarkine où notre homme espérait de s'établir. Le vieux médecin, amusé par les propos de cet aventurier, l'avait invité à dîner. Les citations abondent, les anecdotes, les situations comiques se succèdent durant ce dîner d'une façon amusante, le tout empreint d'une savoureuse philosophie paternelle et bien arabe. Il démontre en même temps l'avantage qu'il y a de s'adresser au besoin à un véritable médecin qui a de la valeur et de l'expérience, et non pas choisir un de ces nombreux charlatans qui pullulaient alors, encombrant l'exercice de la médecine, enlevant les malades aux praticiens et les soignant avec des remèdes empiriques" (p. 15). G. S.

Vallauri, Mario. Filologia sanscrita recente e un nuovo testo sulla scienza delle costruzioni: il "Samarānganasūtradhāra." *Archeion*, 14, 230-45, 1932. ISIS

Includes an analysis of that architectural treatise, the text of which was published for the first time in Baroda, 1924-25, by the late T. GANAPATI SĀSTRĪ (d. 1925). See obituary by SYLVAIN LEVI (*J. A.*, 208, 374-81, 1926). It is divided into 83 chapters. The MS. tradition ascribes it to BHOJADEVA, king of Dhārā from about 1018 to 1060. This text was neglected by PRASANNA KUMARA ACHARYA in his "Dictionary of Hindu architecture" and his "Indian architecture according to Mānasāra Silpasāstra" (1927). G. S.

XIth Century (second half)

Bowen, Harold. UMAR KHAYYAM and a relative of the Nizam al-Mulk. *Bull. of the School of Oriental Studies*, 6, 274-75, 1930. ISIS

Sudhoff, Karl. CONSTANTIN, der erste Vermittler muslimischer Wissenschaft ins Abendland und die beiden Salernitaner Fruehscholastiker MAURUS und URSO, als Exponenten dieser Vermittlung. *Archeion*, 14, 359-69, 1832. ISIS

Thompson, Daniel V., jr. The *De clarea* of the so-called "ANONYMUS BERNENSIS." *Technical Studies in the Field of the Fine Arts*, 1, 8-19, 70-81, 1932. ISIS

Third and improved edition with English translation and with abundant notes of this important text "one of the most precious records of mediaeval art technology." The first edition by HERMANN HAGEN appeared in 1874, the second by GUY LOUMYER in 1908. The dating of this text is uncertain. Says the author: "HAGEN refers the original composition of the *De clarea* to the ninth century or earlier. LOUMYER, on the other hand, puts it at about 1100. Actually, the script of the present copy points to the early twelfth century, or to the close of the eleventh; and it is reasonable to assume some interval between the original redaction and the copying of the text into its place in the Berne miscellany. As there is no positive evidence that it should be assigned to an earlier period, the *De clarea* may perhaps be fairly described as a fragmentary extract from a lost work of the second

half of the eleventh century." The original unique Ms. (Berne A.91.17) consists of five folios, one of which contains medical receipts the text of which is reproduced in a long footnote. G. S.

XIIth Century (second half)

Casanova, Paul. La montre du Sultan NOUR AD DIN (554 de l'Hégire — 1159-1160). *Syria*, 4, 282-99, 3 pl., 3 fig., 1923. ISIS

Apropos of a kind of portable sundial now in the Cabinet des médailles of Paris, bought in Beirût in 1895. "C'est une plaquette rectangulaire de cuivre mesurant sur le petit côté 51 mm.; sur le grand 86 mm. Le haut se termine en chapiteau multilobé percé de deux trous circulaires au centre, et portant un anneau mobile ou bélière. La longueur totale, y compris celle du chapiteau et abstraction faite de l'anneau, est de 98 mm." Elaborate description and discussion, concluding : " On voit que la montre du sultan NOÛR AD DIN, malgré ses particularités remarquables, n'est pas isolée dans l'histoire de la gnomonique, qu'elle se rattache à une conception égyptienne assez ancienne et que de son type dérive celui du cylindre conservé jusqu'à nos jours dans les Pyrénées françaises." G. S.

Dussaud, René. Le sanctuaire phénicien de Byblos d'après BENJAMIN DE TUDÈLE. *Syria*, 7, 247-56, 3 fig., 1926. ISIS

« BENJAMIN DE TUDÈLE vit le sanctuaire de Byblos dans ses dispositions essentielles, c'est-à-dire avec ses statues colossales, un autel, certainement aussi avec les colonnes dont les bases subsistent et avec le pavement conservé en partie. »

Sudhoff, Karl. CONSTANTIN, der erste Vermittler muslimischer Wissenschaft ins Abendland und die beiden Salernitaner Fruehscholastiker MAURUS und URSO, als Exponenten dieser Vermittlung. *Archeion*, 14, 359-69, 1932. ISIS

XIIIth Century (whole and first half)

Aron, Marguerite. Un animateur de la jeunesse au XIII^e^ siècle. 396 p. Paris, DESCLÉE, DE BROUWER, no date (1930). ISIS

Livre consacré à JOURDAIN DE SAXE, premier successeur de ST. DOMINIQUE à la tête de l'ordre des Frères Prêcheurs, et que Mlle ARON identifie avec JORDANUS NEMORARIUS (voir SARTON : *Introd.*, 2, 613-16). L. G.

Sauvaget, J. Un bain damasquin du XIII^e^ siècle. *Syria*, 11, 370-80, 1 pl., 7 fig., 1930. ISIS

Well illustrated description of the Ḥammām Sāmi near the Great Mosque of Damascus, dating from the beginning of the thirteenth century. It was probably a private bath of the amīr USĀMA AL-ḤALABĪ. A reference to this description should be added to my note on ḥammāmāt in my *Introduction* (vol. 2, 631). G. S.

Wittek, Paul. Datum und Herkunft der Automaten-Miniaturen. *Der Islam*, 19, 177-78, 1931. ISIS

Apropos of RIEFSTAHL's memoir of 1929 (*Isis*, 13, 427; *Introd.*, 2, 633) according to which the date of that famous MS. of AL-JAZARĪ's treatise is 1354. G. S.

XIIIth Century (second half)

Aga-Oglu, Mehmet. A note on the manuscript of Manafi al-Hayawan in the library of Mr. J. P. MORGAN. *Parnassus*, 5, 19, 1933. ISIS

Written in Marāgha in 690 H = 1291 A.D. This is the Ms. I referred to in my *Introduction* (vol. 2, 1073). G. S.

Scharold, Hans. Die Physiognomik des ALBERTUS MAGNUS und die moderne Wissenschaft. *Bayer. Blätter für das Gymnasialschulwesen*, 68, 289-301, 1932. ISIS

Die Beschreibung der Temperamente bei ALBERT DEM GROSSEN stimmt mit den modernen überein : " Die Namen wechseln, aber die Ideen bleiben dieselben." K. V.

Steiner, A. GUILLAUME PERRAULT and VINCENT OF BEAUVAIS. *Speculum*, 8, 51-58, 1933. ISIS

The fifth book of GUILLAUME PERRAULT's *Eruditio principum* " bears all the marks of being a compilation made from VINCENT OF BEAUVAIS' *De Eruditione Filiorum Regalium*. Without examining the manuscript traditions of the work ascribed to PERRAULT, it cannot be decided whether the compilation was done by GUILLAUME PERRAULT, or by a minor author of his age, or whether it was made at a later date. The last supposition seems most probable since it is unlikely that in 1265, sixteen years after VINCENT's treatise, such a manifest plagiarism could have escaped notice. Like the *Secunda* of ST. THOMAS AQUINAS' *Summa Theologiae* which was later incorporated into VINCENT OF BEAUVAIS' *Speculum Morale*, in all probability, the compilation drawn from VINCENT's pedagogical treatise was interpolated at a later date into *De Eruditione Principum*."

Wallerard, Gaston. HENRI BATE de Malines. *Speculum Divinorum et quorundam naturalium* (t. XI de la collection : *Les philosophes belges*). XXXIV+240 p. Louvain, Institut supérieur de philosophie, 1931. ISIS

XIVth Century (whole and first half)

Froehner, Reinhard. Die Tierheilkunde des ABU BEKR IBN BEDR. 150 p., 7 fig. (*Abhandlungen aus der Geschichte der Veterinärmedizin*, hrsg. von der Gesellschaft für Geschichte und Literatur der Veterinärmedizin. Heft 23). Leipzig, RICHTER, 1931. ISIS

" ABU BEKR IBN BEDR war Hoftierarzt des ägyptischen Sultans EL-NASER, Sohnes des KALAÛN, und schrieb für seinen Souverain ein Buch, genannt Kamil assanaatin, d. h. ' Der Vollendete in den beiden Künsten,' nämlich in der Kunst der Pferdezucht (und -dressur) und in der Pferdeheilkunst. Die Abfassung des Buches, das auch das Naserische Buch genannt wird, fällt in das erste Drittel des 14. Jahrhunderts. Der Verfasser war der Sohn des BEDR EL-DIN, der auch Pferdearzt und Pferdezüchter gewesen sein muss, weil ABU BEKR sich vielfach auf die Erfahrungen und Anschauungen des Vaters in tierärztlichen Dingen beruft..." " Das Werk ist sehr umfangreich. Obgleich aus verschiedenen Abteilungen einzelne Stücke übernommen sind, habe ich im wesentlichen allein den 3. Band, die Hippiatrik, übersetzt, weil sie für die tierärztliche Fachgeschichte der wichtigste Teil des Buches ist."

This work is based on PERRON's French translation (3 vols., Paris, 1852-60).

G. S.

Gessler, Jean. Médecins et chirurgiens d'après les manuels de conversation du XIV^e^ et du XV^e^ siècle. *Janus*, 36, 311-17, 1932.

ISIS

A propos du « Livre des Mestiers » (*Isis*, 19, 261).

Pelliot, Paul. Les formes turques et mongoles dans la nomenclature zoologique du Nuzhatu-l-qulûb. *Bull. of the School of Oriental Studies*, 6, 555-80, 1931. ISIS

Apropos of the late Col. STEPHENSON's edition of the Persian text of the zoological section of the Nuzhatu-l-qulûb (London, 1928; *Isis*, 13, 435).

XIVth Century (second half)

Gibb, H. A. R. The Islamic background of IBN KHALDÛN's political theory. *Bulletin of the School of Oriental Studies*, 7, 23-31, 1933.

ISIS

" It is impossible to avoid the impression that IBN KHALDÛN, besides setting out to analyse the evolution of the State, was, like the other Muslim jusists of his time, concerned with the problem of reconciling the ideal demands of the Sharî'a with the facts of history. The careful reader will note how he drives home the lesson, over and over again, that the course of history is what it is because of the infraction of the Sharî'a by the sin of pride, the sin of luxury, the sin of greed. Even in economic life it is only when the ordinances of the Sharî'a are observed that prosperity follows. Since mankind will not follow the Sharî'a it is condemned to an empty and unending cycle of rise and fall, conditioned by the ' natural ' and inevitable consequences of the predominance of its animal instincts. In this sense IBN KHALDÛN may be a ' pessimist ' or ' determinist,' but his pessimism has a moral and religious, not a sociological, basis."

Herrick, James B. Why I read CHAUCER at seventy. *Annals of Medical History*, 5, 62-72, 1933. ISIS

Rosenthal, Erwin. IBN KHALDUNS Gedanken über den Staat. Ein Beitrag zur Geschichte der mittelalterlichen Staatslehre. VIII+118 p. München, OLDENBOURG, 1932. ISIS

Divided into two main parts: 1. The state, its origin, development, conception, nature, and purpose; 2. State and culture. The final summary contains a very interesting comparison between IBN KHALDÛN and MACHIAVELLI much to the former's advantage. To the Machiavellian ideas of virtù, necessità and fortunà, correspond the Arabic 'aṣabiyya. The author concludes: "So zeichnen IBN KHALDÛN grössere Gesichtsweite, weiterreichender historischer Sinn, leidenschaftslose Betrachtung und Freisein von jeder politischen Tendenz aus und grenzen den Forscher und Deuter gegen den Politiker MACHIAVELLI ab, der gleichzeitig auch Ratgeber und Erzieher zu einem geeinten Italien sein wollte. MACHIAVELLI forscht nach den Ursachen der Erscheinungen — die er vorwiegend unter politischen Gesichtspunkten begreift —, um daraus Lehren für die politische Gegenwart zu ziehen. IBN KHALDÛN sucht Ursachen und Zusammenhänge zu ergründen, um daraus allgemeine Gesetze für den Ablauf des historisch-politisch-sozialen Geschehens abzulesen..." "Wenn man beide Männer schliesslich noch einmal zusammenfassend in ihrem Denken über den Staat betrachtet, so ist ihnen gemeinsam die Loslösung des Staates von der Religion, von der Suprematie der Kirche und die untheologische, völlig weltliche Betrachtungsweise des Staates. Beide denken rein realistisch und lassen sich nicht durch ethische und metaphysische Erwägungen lenken, sondern betrachten nüchtern, wie der Staat in Wirklichkeit ist" (p. 113). Short glossary of Arabic terms, and bibliography. G. S.

Somogyi, Josef von. Die Chalîfengeschichte in DAMÎRÎ's "Ḥajât al-ḥajawân." *Der Islam*, 18, 154-58, 1929. ISIS

Winkler, H. A. Eine Zusammenstellung christlicher Geschichten im Artikel über das Schwein in DAMÎRÎ's Tierbuch. *Der Islam*, 18, 285-93, 1929. ISIS

XVth Century (whole and first half)

Alos-Moner, R. d'. Contribució a la biografia de LORENZO VALLA. *Miscellania Crexells*, p. 1-7, Barcelona, 1929. ISIS

Edwards, E. D.; Blagden, C. O. A Chinese vocabulary of Malacca Malay words and phrases collected between A.D. 1403 and 1511 (?) Transcribed, translated, and edited. *Bull. of the School of Oriental Studies*, 6, 715-49, 1931. ISIS

"The list of words and phrases contained in this article is one of ten manuscript vocabularies bound up in a volume lettered *Ko Kwo Yi Yü* which forms part of the collection of Chinese books made by the wellknown missionary, MORRISON (who lived from 1782-1834), and has been deposited on permanent loan by University College, London, in the Library of the School of Oriental Studies."

Taeschner, Franz. GEORGIOS GEMISTOS PLETHON. Ein Beitrag zur Frage der Übertragung von islamischem Geistesgut nach dem Abendlande. *Der Islam*, 81, 236-43, 1929. ISIS

Followed by a note " Über einige Fälle von Ketzerverbrennung bei den Osmanen."

XVth Century (second half)

Butler, C. S. Caligula or history's debt to syphilis. *Annals of Medical History*, 4, 560-64, 1932. ISIS

Uncritical.

Ebstein, Erich. What was SAVONAROLA's ailment? *Medical Life*, 39, 645-46, 1932. ISIS

Killermann, S. Behandlung einer Leiche auf einem Pilgerschiffe im Jahre 1483. *Sudhoffs Archiv für Geschichte der Medizin*, 26, 82-84, 1933. ISIS

Apropos of *Fratris Felicis Fabri Evagatorium in Terrae Sanctae, Arabiae et Egypti peregrinationem*, ed. C. D. HASSLER, Tom. III (Stuttgartiae 1849) p. 296.

Krumbhaar, E. B.; Garner, V. C. Luesiana in the library of the College of Physicians of Philadelphia exhibited to celebrate the 25th anniversary of the discovery of the spirocheta pallida. *Annals of Medical History*, 5, 96-100, 1933. ISIS

Wolfson, Harry Austryn. ISAAC IBN SHEM-TOB's unknown commentaries on the *Physics* and his other unknown works. Reprinted from the A. S. FREIDUS *Memorial volume*, 279-90, New York, 1929. ISIS

The author proves that two anonymous commentaries " belong to ISAAC IBN SHEM-TOB and are his ' first ' and ' third ' supercommentaries on AVERROËS' Intermediate Commentary on the *Physics*. Furthermore, bound together with these two works are a few fragments of still another commentary on the *Physics* (Cod. R. 8.19.1) which resembles the former two in general style and form. It is not impossible that these fragments are the remains of a ' fourth ' commentary by ISAAC IBN SHEM-TOB. He who has written three commentaries on the *Physics* and who, according to the testimony of his pupil, was ' an inexhautible fountain ' might have written a fourth commentary. As a teacher actively engaged in expounding the text of the *Physics* to successive classes of students, he must have found it necessary to revise his notes from time to time and hence this series of four commentaries." (p. 288) WOLFSON has compiled a list of ISAAC's extant and lost works. He concludes (p. 290) : " It is interesting to compare the literary activity of ISAAC IBN SHEM-TOB with that of his older brother JOSEPH IBN

SHEM-TOB and of his nephew SHEM-TOB BEN JOSEPH IBN SHEM-TOB. They were all prolific writers of commentaries on standard philosophic texts. This must have become a sort of family specialization with them as translation had been with the Tibbonites. They also show a common interest in their choice of subject. All of them wrote commentaries on the *Moreh nebukim* and on selected works of AVERROËS. They all were critical students of HASDAI CRESCAS, showing a rather hostile attitude toward him, as a result, perhaps, of their reaction against the opposition to philosophy on the part of their father, SHEM-TOB IBN SHEM-TOB. The works of ISAAC and his nephew SHEM-TOB contain rather caustic remarks about the author of the *Or Adonai* and JOSEPH is not only the friendly translator of CRESCAS' work against Christianity but also its severe critic." G. S.

Leonardo da Vinci

Gliozzi, Mario. L'invenzione della camera oscura. *Archeion*, 14, 221-29, 1932. ISIS

La découverte de la chambre noire est en général attribuée à GIOV. BATTISTA PORTA. L'auteur en donne la paternité à LÉONARD DE VINCI; l'invention fut diffusée par la tradition orale, et publiée pour la première fois par CÉSAR CESARIANO (1521) dans une traduction commentée de VITRUVE, et attribuée par lui à un certain PAPNUTIO. En 1550, CARDANO parle de l'adjonction d'une lentille à l'ouverture de la chambre noire, mais la découverte doit être antérieure à cette date, et ne peut être attribuée à CARDANO. PORTA, en 1558 emploie un miroir concave pour redresser l'image. DANIEL BARBARO (1567) a l'idée du diaphragme pour diminuer l'aberration de sphéricité de la lentille, qu'il avait observée. En 1573, EGNATIO DANTI décrit la chambre noire, sans lentille, et conseille pour redresser l'image, l'emploi d'un miroir plan. (Voir *Isis*, 8, 511). L. G.

XVIth Century (whole and first half)

A. — *Mathematics*

Ginsburg, J. Predecessors of MAGINI. *Scripta mathematica*, 1, 168-89, 1932. ISIS

Apropos of symbols used as a decimal separatrix.

B. — *Physical sciences and technology*

Hart, Ivor B. The transition from the mediaeval to the modern outlook in pure and applied science: GEORGIUS AGRICOLA and the rise of metallurgical science. *Scientia*, 52, 311-21, 1932. ISIS

Lippmann, E. O. von. Zur Entdeckung des Wasserstoffes durch PARACELSUS. *Chemiker-Zeitung*, 56, 193, 1932. ISIS

Strunz, Franz. Die Alchemie und das alchemistische Weltbild bei THEOPHRASTUS PARACELSUS. *Archeion*, 14, 76-87, 183-97, 1932. ISIS

Examen de la vision alchimique du monde chez PARACELSE. La fin essentielle de l'alchimie est, pour PARACELSE, non pas de fabriquer de l'or, mais de séparer des métaux leurs scories. L'alchimie tend à la perfection morale de l'homme, et en même temps à la connaissance unitaire du micro et du macrocosme. L'alchimie et la médecine sont science des causes. L'alchimie est philosophie, donc la philosophie est étude de la nature. L. G.

Vetter, Quido. NICOLAS KOPERNIK et la Bohême. 2 p. Congrès International des Mathématiciens Zurich, 1932. (No indication of place or date, received March 1933). ISIS

C. — *Natural sciences*

Gabriel, Albert. Les étapes d'une campagne dans les deux Irak d'après un manuscrit turc du XVI[e] siècle. *Syria*, 9, 328-49, 11 pl., 3 fig., 1928. ISIS

« La bibliothèque de l'Université de Stamboul s'est enrichie, en 1924, des ouvrages qui composaient la bibliothèque du palais de Yildiz. Parmi les nombreux manuscrits qui furent alors recueillis, figure une chronique signée, datée et illustrée de nombreuses miniatures qui donne le récit de la campagne de SULEIMAN en Perse. En attendant l'achèvement du catalogue en cours d'exécution, ce manuscrit est désigné provisoirement sous la cote : Yildiz, Histoire, 35 ». La date du Ms. est 944 (1537-8). Le Ms. renferme des miniatures et des cartes fort curieuses. G. S.

D. — *Medical sciences*

Artelt, Walter. PARACELSUS im Urteil der Medizinhistorik. *Fortschritte der Medizin*, 50, 12 p., 1932. ISIS

Farrington, B. The preface of ANDREAS VESALIUS to *De Fabrica Corporis Humani* 1543. *Proceedings of the Royal Society of Medicine*, 25, 1357-66, 1932. ISIS

The author has translated from Latin into English the preface to the first great masterpiece of anatomy. The version appears to be close and faithful, slightly modernized by introducing paragraphs, by breaking up some of the longer sentences and by omitting occasional redundancies. The paging corresponds to the first edition of 1543; some of the more important Latin terms are given as footnotes. The translation, supervised by Dr. CHARLES SINGER, is worthy of great praise. H. R. V.

Lint, J. G. de. Eine der ersten Guayakschriften. *Janus*, 36, 384-92, 1932. ISIS

Reproduction avec commentaires d'une recette pour l'emploi du bois de gaïac contre le « mal français » datant du début du 16e siècle et traduite de l'espagnol en allemand. L. G.

Paracelsus. Sämtliche Werke, nach Huser's 10-bändiger Gesamtausgabe (1589-1591) zum erstenmal in neuzeitliches Deutsch übersetzt, von BERNHARD ASCHNER. Bd. 4, 1163 p., 124 fig. Jena, FISCHER, 1932. ISIS

Reviewed by E. O. VON LIPPMANN, *Chemiker-Zeitung*, 56, 855, 1932.

Zimmerman, Ernest L. The French Pox of that great clerke of Almayne, ULRICH HUTTEN, knyght. *Janus*, 36, 235-50, 265-82, 297-310, 5 pl., 1932. ISIS

ULRICH v. HUTTEN (1448-1523).—Notes biographiques. Ses observations, faites sur lui-même, des accidents de syphilis tertiaire. Ses remarques sur les différents traitements employés entre 1510 et 1518. Le traitement au bois de gaiac : « Ulrichi de Hutten eq. de gaiaci medicina et morbo gallico liber unus » (1519); traduction allemande, 1519; traduction française, 1525; traduction anglaise, 1536. — Les œuvres complètes de v. HUTTEN ont été éditées par EDOUARD BÖCKING, 1859-62 (Leipzig, TEUBNER). L. G.

E. — *Alia*

Babinger, Franz. MARINO SANUTO's Tagebücher als Quelle zur Geschichte der Ṣafawijja. A volume of Oriental studies presented to EDWARD G. BROWNE, p. 28-50, Cambridge University Press, 1922. ISIS

Blagden, C. O. Two Malay letters from Ternate in the Moluccas, written in 1521 and 1522. Edited and translated by C. O. BLAGDEN. *Bull. of the School of Oriental Studies*, 6, 87-101, 2 pl., 1930. ISIS

These two letters " were written in the name of Sultan ABU HAYAT of Ternate, when he was about 7 years old, and are of peculiar interest as being, perhaps, the oldest Malay letters extant."

XVIth Century (second half)

A. — *Mathematics*

Barbour, J. M. A sixteenth century Chinese approximation for π. *American Mathematical Monthly*, 40, 69-73, 1933. ISIS

Vetter, Q. Rapporto sulle lettere indirizzate al Dottor TADDEO HAGECIUS DA HAYCK, astronomo, medico e matematico ceko conservate a Breslavia. *Atti del Congresso Internazionale dei Matematici*, 499-501, Bologna, 1928. ISIS

XVIIth Century (whole and first half)

A. — *Mathematics*

Caspar, Max. KEPLER und die Infinitesimalrechnung. *Unterrichtsbl. Math.*, 38, 227-29, 1932. ISIS

Josey, E. Les antécédents de l'infiniment petit dans PASCAL. 229 p. Paris, VRIN, 1932. ISIS

Lhermet, Jean. PASCAL et la Bible. IV+708 p. Paris, VRIN, 1931. ISIS

Reviewed by FRITZ SCHALK, *DLZ*, 4, 209-15, 1933.

Leroy, Maxime. DESCARTES social. Avec un portrait inédit de DESCARTES dessiné par JEAN LIÉVENS aux environs de 1643. XIV+73, p. Paris, VRIN, 1931. ISIS

Mauriac, François. BLAISE PASCAL et sa sœur JACQUELINE. Le passé vivant. Paris, HACHETTE, 1931. ISIS

Molinéry (de Luchon). Le cas de "M. PASCAL." *Paris méd.*, 84, 159, 1932. ISIS

Noguès, R. Théorème de FERMAT. Son histoire. 177 p. Paris, VUIBERT, 1932. ISIS

Reviewed by L. P., *Revue générale des sciences*, 43, 482, 1932.

Schub, Pincus. A manuscript on geodesy from the Bastille. *Scripta mathematica*, 1, 142-46, 1932. ISIS

"Among the various mathematical manuscripts in the possession of the American Philosophical Society Library in Philadelphia there is one, the oldest of them all, bearing the following title : Arithmetica Decimalis, oder Rechenkunst der Geometrischen Zehen theiligen Ruthen geschrieben in Paris durch mich FELIX HANNIBAL RAUSCHARDT Anno Domini 1648. A note on its flyleaf reads : 'Found in the Bastile and presented by PETER S DU PONCEAU Esq^re to WM. DUER Jun^r the 12 of No^r 1796'."

Walker, Evelyn. A study of the Traité des indivisibles of GILLES PERSONE DE ROBERVAL with a view to answering, insofar as is possible, the two questions : Which propositions contained therein are his own, and which are due to his predecessors or contemporaries? and, What effect, if any ,had this work on his successors ? VI+272 p. New York, Columbia University, 1932. ISIS

Reviewed by LAO GENEVRA SIMONS, *Scripta Mathematica*, 1, 80-83, 1932.

B. — *Physical sciences and technology*

Moon, R. O. VAN HELMONT, chemist, physician, philosopher and mystic. *Proceedings of the Royal Society of Medicine*, 25, 23-28, 1931. ISIS

C. — *Natural sciences*

(Champlain, Samuel de.) The works of SAMUEL DE CHAMPLAIN. Reprinted, translated, and annotated under the general editorship of H. P. BIGGAR. Volume IV., 1608-1620. Translated by H. H. LANGTON, the French text collated by J. HOME CAMERON. XVI+373 p. (*Publications of the Champlain Society.*) Toronto, the Society, 1932. ISIS

Reviewed by GEORGE M. WRONG, *American Historical Review*, 38, 319-20, 1933.

Harlow, Vincent Todd. RALEGH's last voyage. Bring an account drawn out of contemporary letters and relations, both Spanish and English, of which the most part are now for the first time made public, concerning the voyage of Sir WALTER RALEGH, knight, to Guiana in the year 1617 and the fatal consequences of the same. 379 p., maps. London, Argonaut Press, 1932. ISIS

Kew, Harry Wallis ; Powell, H. E. THOMAS JOHNSON, botanist and royalist. XI+151 p., 13 pl. London, LONGMANS, 1932. ISIS

Moreland, William Harrison. Relations of Golconda in the early seventeenth century. London, Hakluyt Society, 1931. ISIS

Reviewed by H. D., *Bull. of the School of Oriental Studies*, 6, 1082, 1932.

(Ólafsson, Jón). The life of the Icelander JÓN ÓLAFSSON, traveller to India. Written by himself and compiled about 1661 A.D., with a continuation by another hand, up to his death in 1679. Translated from the Icelandic edition of SIGFÚS BLÖNDAL by BERTHA PHILLPOTTS. Vol. II. Life and travels : Denmark, England, the Cape, Madagascar, Comoro Is., Coromandel Coast, Tranquebar, St. Helena, Ascension Is., Ireland, Iceland, 1618-1679. Edited by Sir RICHARD TEMPLE and LAVINIA MARY ANSTEY. XXX+290 p. London, Hakluyt Society, 1932. ISIS

Vol. I published in 1923.

Ostachowski, Emiljan. JAN BAPTYSTA VAN HELMONT (1577-1644) i jego filozofja przyrody (JOHANN BAPTIST VAN HELMONT und seine

Naturphilosophie). 72 p., 1 pl., 3 fig. Cracow, GEBETHNER i WOLFF, 1932 (Polish). ISIS

Reviewed by BILIKIEWICZ, *Mitteilungen z. Gesch. d. Med.*, 31, 152, 1932.

Penrose, Boies. The travels of Captain ROBERT COVERTE. Edited, with an introduction and notes. 115 p., 1 map. Philadelphia, Privately printed, 1931. ISIS

Reviewed by W. F. *Journal of the Royal Asiatic Society*, 176, 1932.

Van Helmont, Johannes Baptista (1577-1644). Ex opera eius " Ortus medicinae " capita duo : Archeus faber, et spiritus vitae. Aus seinem Werke " Aufgang der Artzneykunst " der sechste Tractat : Von dem Archeus, und der siebenundzwantzigste Tractat : Vom Lebens-Geist. Der lateinische Text aus " Ortus medicinae " und die deutsche Uebersetzung aus " Aufgang der Artzney-Kunst " vom Jahre 1683. *Opuscula selecta Neerlandicorum De arte medica*, Fasc. XI, Amsterdam, Nederlandsch Tijdschrift voor Geneeskunde, 1932. p. 45-88, 4 pl. ISIS

One of the classics of vitalistic literature in the original Latin with German translation. Portrait of the author and facsimile title pages. G. S.

D. — *Medical sciences*

Busquet. Les causes des maladies d'après la *Medicina catholica* de ROBERT FLUDD, 1631. *Progrès médical*, suppl. ill., 89-92, 1930. ISIS

ROBERT FLUDD, 1574-1637.

Ghesel, John. A facsimile of the rule of health. As printed by JOHN LICHFIELD, at Oxford, in the year 1631. Ann Arbor, Mich., EDWARDS, 1932. ISIS

Guelliot, O. ANDRÉ OUDET. Recteur de l'Université, Professeur et doyen de la Faculté de Médecine de Reims. 7 p. (L'Almanach Matot-Braine pour 1931). Reims, MATOT-BRAINE, 1931. ISIS

ANDRÉ OUDET, 1590-1665. Reviewed in *Bulletin de la Société française d'Histoire de la Médecine*, 26, 75-76, 1932.

Herringham, Sir Wilmot. The life and times of Dr. WILLIAM HARVEY. *Annals of Medical History*, 4, 249-72, 347-63, 491-502, 575-89, 6 fig., 1932. ISIS

Hoeven, J. van der. Een brief van JUSTINUS VAN ASSCHE aan ISAÄC

BEECKMAN. *Bijdragen tot de geschiedenis der geneeskunde*, 13, 17-23, 1933. ISIS

Lévy-Vallensi, J. La médecine et les médecins français au XVII^e siècle. 668 p., 51 pl., 86 fig. Paris, J. B. BAILLIERE, 1933. ISIS

Ouvrage fort bien équilibré, et qui donne ce que promet son titre : un exposé des doctrines médicales au cours du XVII^e siècle (215 p.) (les résistances qui se dressèrent devant les « circulateurs » et HARVEY sont bien mises en évidence); ce qu'était à Paris, à Montpellier, à Aix, l'enseignement médical (pp. 219-297); l'hospitalisation des malades, l'internement des aliénés, les consultations gratuites (pp. 301-349); les médecins, les chirurgiens, les accoucheurs et les sages-femmes, les apothicaires, les empiriques (pp. 353-433); les 130 dernières pages du volume sont occupées par quelques biographies de médecins parmi lesquels l'auteur a ménagé la place la plus grande à THÉOPHRASTE RENAUDOT, dont les études médicales, faites à Montpellier, ont tout juste duré neuf mois, à JEAN HAMON, médecin de Port-Royal, à PIERRE MICHON, plus connu sous le nom d'Abbé BOURDELOT, qui s'ils n'étaient pas de grands médecins, ont cependant joué un rôle considérable, et à GUI PATIN. L'illustration est intéressante, encore que les figures d'ARISTOTE, d'HIPPOCRATE et de GALIEN, ne semblent pas à leur place dans un volume consacré au XVII^e siècle. L. G.

Miller, William Snow. A correction of KEYNES' bibliography of the writings of WILLIAM HARVEY, M. D. *Janus*, 37, 31-32, 1933. ISIS

E. — *Alia*

(Althusius, Johannes). Politica methodice digesta. Reprinted from the third edition of 1614. Augmented by the preface to the first edition of 1603 and by 21 hitherto unpublished letters of the author. With an introduction by CARL JOACHIM FRIEDRICH. CXXXIX+435 p. (Harvard Political Classics, 2). Cambridge, Mass., Harvard University Press, 1932. ISIS

Bligh, E. W. Sir KENELM DIGBY and his Venetia. XIX+331 p. London, LOW, 1932. ISIS

(Comenius). COMENIUS in England : the visit of JAN AMOS KOMENSKY (COMENIUS), the Czech philosopher and educationist, to London in 1641-1642 ; its bearing on the origins of the Royal Society, on the development of the Encyclopaedia, and on plans for the higher education of the Indians of New England and Virginia, as described in contemporary documents. Selected, translated and edited, with an introduction, and tables of dates, by ROBERT FITZGIBBON YOUNG. VII+99 p., 12 pl. London, Oxford University Press, 1932. ISIS

Reviewed by J. G. F. D., *Nature*, 131, 306-07, 1933.

Descartes. Regulae ad directionem ingenii. Règles pour la direction de l'esprit. Texte revu et traduit par GEORGES LE ROY. XXII+224 p., Paris, BOIVIN, s. d. (1933). ISIS

Ce volume inaugure une « Bibliothèque de Philosophie » qui se propose de donner, sous une forme simple, des textes que peut difficilement posséder à l'heure actuelle, l'étudiant ou le professeur. Elle entend « rendre des services analogues à ceux que rendent dans d'autres domaines, la collection Guillaume Budé ou la collection « les textes français ». L'initiative est fort intéressante, et je souhaite à la jeune « Bibliothèque » le succès que rencontrent les deux collections sur la trace de qui elle entend marcher.

Peut-être cependant n'a-t-elle pas très bien choisi, au point de vue utilitaire, le texte de son volume inaugural. Il eut mieux valu donner un texte vraiment difficile à atteindre, que les Regulae (texte ADAM-TANNERY) déjà publiées en 1930 par HENRI GOUHIER d'après la même édition, mais avec en plus l'appareil critique de cette édition.

Les éditeurs annoncent pour les volumes suivants des textes de CONDORCET, RAVAISSON, CL. BERNARD, MALEBRANCHE, SPINOZA, LEIBNIZ, etc. L. G.

Evans, Wilfred Hugo. L'historien MÉZERAY (1610-83) et la conception de l'histoire en France au XVII^e^ siècle. 196 p. Paris, GAMBER, 1930. ISIS

Reviewed by EMILE MAGNE, *Larousse mensuel*, 9, 238-39, 1932.

Gough, John Wiedhofft. The superlative prodigall : a life of THOMAS BUSHELL. VIII+172 p. (University of Bristol Studies, no. 1). Bristol, ARROWSMITH, 1932. ISIS

Reviewed by ABBOTT PAYSON USHER, *American Historical Review*, 38 367-68, 1933.

Hodges, Richard. A special help to orthographie. A facsimile reproduction of the original book, printed for RICHARD COTES, in London, in the year 1643. Ann Arbor, Mich., EDWARDS, 1932. ISIS

Jordan-Smith, Paul. Bibliographia Burtoniana. A study of ROBERT BURTON's " The anatomy of melancholy." With a bibliography of BURTON's writings. XIV+120 p. Stanford, Cal., University Press, 1931. ISIS

Morison, Samuel Eliot. English University men who emigrated to New England before 1646. An advance printing of appendix B to the history of Harvard College in the seventeenth century. 54 p. Cambridge, Mass., Harvard University Press, 1932. ISIS

Segond, J. La sagesse cartésienne et la doctrine de la science. 321 p. Paris, VRIN, 1932. ISIS

Sturt, Mary. FRANCIS BACON: a biography. XVI+246 p., 12 pl. London, KEGAN PAUL, 1932. ISIS

XVIIth Century (second half)

A. — *Mathematics*

Hjelmslev, Johannes. Beiträge zur Lebensbeschreibung von GEORG MOHR (1640-1697). 22 p., 1 facs. (*Math.-fys. Meddelelser udg. af det Kgl. Danske Vidskab. Selskab*, XI, 4). Copenhagen, Høst, 1931. ISIS

Reviewed by ZAUNICK, *Mitteilungen z. Gesch. d. Med.*, 31, 117, 1932.

B. — *Physical sciences and technology*

Boyle, Robert. The sceptical chymist 1661 (History of chemistry reader, 1). Arranged by EDWARD KREMERS for reading by students of the history of chemistry. *American Journal of Pharmacy*, 104, 17 p., 1932. ISIS

(Boyle, Robert). Unrecorded editions of ROBERT BOYLE. *Times Literary Supplement*, 584, London, August 18, 1932. ISIS

Addenda to FULTON, 1932.

Evelyn, John (1620-1706). Fumifugium (1661). Now reissued as an old Ashmolean reprint in the year of the refacing of the old Ashmolean Museum, which, like Fumifugium, was dedicated to King CHARLES II., founder of the Royal Society. VIII+49 p. Oxford, R. T. GUNTHER, 1930. ISIS

Reviewed by R. R., *Nature*, 125, 368, 1930.

Hessen, B. The social and economic roots of NEWTON's "Principia." 62 p. Science at the Cross Roads, London, Kniga, 1931. ISIS

Contents: 1. Introduction. MARX's theory of the historical process; 2. The economics, physics, and technology of NEWTON's period; 3. The class struggle during the English Revolution and NEWTON's philosophic outlook; 4. ENGELS' conception of energy and NEWTON's lack of the law of conservation of energy; 5. The machine-breakers of NEWTON's epoch and the present-day wreckers of productive forces.

Keppler, Gustav. Familiengeschichte KEPPLER. Bd. 1. Genealogie. XXIV+1018 p. Bd. 2: Astronom KEPLER und seine Zeit, mit Schilderung des Hexenprozesses gegen seine Mutter. 855 p. Görlitz, STARKE, 1931. ISIS

Reviewed by WIELEITNER, *Mitteilungen z. Gesch. d. Med.*, 31, 107, 1932.

(Keynes, Geoffrey). Unrecorded editions of BOYLE. *Times Literary Supplement*, p. 596, London, Aug. 25, 1932. ISIS

Addenda to FULTON.

Patterson, T. S. JOHN MAYOW—in contemporary setting. A contribution to the history of respiration and combustion. *Isis*, 15, 47-96, 504-46, 2 pl., 1931. ISIS

Poley, Arthur F. E. St. Paul's cathedral. With introduction by Sir REGINALD BLOMFIELD. XVI+29+VII p., 32 pl. Willowbank, Hampton Hill, Middlesex, the author, 1927. ISIS

Reviewed by F. B., *Nature*, 125, 228-29, 1930.

Uzureau. DENIS PAPIN et la Faculté de médecine d'Angers. *Archives médicales d'Angers*, p. 39-40, mars 1932. ISIS

Reviewed in *Bulletin de la Société française d'histoire de la médecine*, 26, 390, 1932.

Vollgraff, J. A. De rol van den nederlander CASPAR CALTHOFF bij de uitvinding van het moderne stoomwerktuig. *Physica*, 12, 257-68, 1932. ISIS

" It is shown that the Dutchman CASPAR CALTHOFF (CALTHOVIUS, KALTHOF or KALTHOVEN) who was employed by the Marquis of WORCESTER during many years is identical with the instrumentmaker CALTHOFF who stayed at Dordrecht in the years 1645-56. Since CALTHOFF in this period was very busy with the construction of a steam-engine, it may be conjectured that the steam-engine which was patented in 1663 by the Marquis is rather due to CALTHOFF who made very good forms for the polishing of lenses for him and his brother. HUYGENS visited CALTHOFF in England in 1661 and 1663 and saw the engines for the raising of water constructed by WORCESTER and CALTHOFF. He must have spoken of them to PAPIN when working with him at Paris in the years after 1666."

Wiener, Philip Paul. The experimental philosophy of ROBERT BOYLE (1626-91). *Philosophical Review*, 41, 594-609, 1932. ISIS

" To the two conditions which HOBBES lays down for a good hypothesis, viz. ' (1) that it be conceivable; (2) that from its being granted, the necessity of the phenomenon be inferred,' BOYLE would add a third, ' that it be not inconsistent with any other phenomenon or truth of nature.' This curious non-experimental and quite formal criterion shows that BOYLE himself realized the need of structural connection in his experimental histories. The same honesty led him to talk inconsistently about final causes in his pious discourses on things above reason after he had rejected final causes in his mechanical philosophy of nature. The metaphysical lacuna in his thinking between the diversities and the structural identities of nature resulted from his trying to do justice to the former in his experiments and leaving the latter for his theological speculations."

C. — *Natural sciences*

Beydals, Petra. LEEUWENHOECK-Brief no. 27, en andere gegevens. *Bijdragen tot de geschiedenis der geneeskunde*, 13, 31-36, 1933. ISIS

Beydals, Petra. Twee testamenten van ANTONI VAN LEEUWENHOECK. *Bijdragen tot de geschiedenis der geneeskunde*, 13, 67-79, 1933. ISIS

Borelli, Johann Alfons. Die Bewegung der Tiere. Übers. u. m. Anmerk. versehen v. MAX MENGERINGHAUSEN. 70 p., 28 fig. (*Ostwald's Klassiker*, Nr. 221). Leipzig, Akad. Verlagsges., 1927. ISIS

Dobell, Clifford. ANTONY VAN LEEUWENHOEK and his " little animals." Being some account of the father of protozoology and bacteriology and his multifarious discoveries in these disciplines. Collected, translated, and edited, from his printed works, unpublished manuscripts, and contemporary records. VII+435 p., 32 pl. Published on the 300th anniversary of his birth. London, BALE, SONS & DANIELSSON, 1932. ISIS

Reviewed in *Nature*, 130, 679-80, 1932.

Goblet, Yann Morvran. La transformation de la géographie politique de l'Irlande au XVII[e] siècle dans les cartes et essais anthropogéographiques de Sir WILLIAM PETTY. Deux tomes. Paris, BERGER-LEVRAULT, 1930. ISIS

Labat, Jean Baptiste. Nouveau voyage aux isles de l'Amérique. (Voyage au pays des flibustiers et des Caraïbes). Préface de CHARLES MARCHESNÉ. VII+194 p., pl. Paris, Les Œuvres Représentatives, 1931. ISIS

Leeuwenhoek, Anthony van. *Opuscula selecta Neerlandicorum de arte medica*, fasciculus nonus : Veertien tot heden geheel onuitgegeven brieven van ANTHONY VAN LEEUWENHOEK uit de jaren 1674-1678 (fourteen hitherto totally unpublished letters of ANTHONY VAN LEEUWENHOEK from the years 1674-1678). LXXVI+148 p., 15 pl. Amsterdam, 1930. ISIS

Reviewed by ALDO MIELI, *Archeion*, 14, 331-34, 1932.

Lower, Richard (1631-91). *De corde*. By RICHARD LOWER, London, 1669. With introduction and translation by K. J. FRANKLIN. (R. T. GUNTHER, *Early science in Oxford*, vol. 9). XXXV+374 p., 8 pl. Oxford, GUNTHER, 1932. ISIS

Reviewed in *Nature*, 130, 946-47, 1932.

Pelliot, Paul. Le premier voyage de " L'Amphitrite " en Chine. L'Origine des relations de la France avec la Chine, 1698-1700. 79 p. Paris, GEUTHNER, 1930. ISIS

Reviewed by A. C. M., *Journal of the Royal Asiatic Society*, 189-92, 1932; by W. VOGEL, *OLZ*, 35, 499, 1932.

Pijoan, Michel. A new and hitherto unpublished portrait of MARCELLO MALPIGHI. *Bulletin of the Institute of the History of Medicine*, The Johns Hopkins University, 1, 81-84, 1 fig., 1933. ISIS

Rava, Luigi. Il Conte MARSIGLI e il caffè. Dal volume " Memorie intorno a LUIGI FERDINANDO MARSILI." Bologna, ZANICHELLI, 1930. ISIS

Apropos of *Bevanda asiatica* (1685) by LUIGI FERDINANDO MARSIGLI (1658-1730), and of other similar writings on coffee and chocolate. A. P.

Schierbeek, A. Leven en werken van ANTONY VAN LEEUWENHOEK. *Bijdragen tot de geschiedenis der geneeskunde*, 12, 209-23, 1932. ISIS

Stel, Simon van der. SIMON VAN DER STEL's Journal of his expedition to Namaqualand, 1685-86. Edited from the manuscript in the library of Trinity College, Dublin, by GILBERT WATERHOUSE. XXVIII+183 p., 45 pl. London, LONGMANS, GREEN, 1932. ISIS

Tavernier, Jean-Baptiste (1605-1689). Voyages en Perse et description de ce royaume, publiés par PASCAL PIA. 351 p. (Collection *Voyages et découvertes*). Paris, Carrefour, 1930. ISIS

Reviewed by V. MINORSKY, *Bull. of the School of Oriental Studies*, 6, 786-87, 1931.

D. — *Medical sciences*

Berghoff, Emanuel. Ein Verteidiger des PARACELSUS im 17. Jhdt. in Altösterreich. *Wien. med. Wschr.*, Nr. 38, 8 S., 1932. ISIS

Betz, Hans. Westindische und westafrikanische Volkskrankheiten um das Jahr 1700, nach Père JEAN BAPTISTE LABAT. 55 p. Diss. Würzburg, 1931. ISIS

Reviewed by HABERLING, *Mitteilungen zur Geschichte der Medizin*, 31, 62-63, 1932.

Faber, Knud. THOMAS SYDENHAM, der englische Hippokrates und die Krankheitsbegriffe der Renaissance. *Münch. med. Wschr.*, 79, 29-33, 1932. ISIS

Felsenthal, S. Dr. med. NICOLAS LA ROSE, Stadtarzt und Stadtbaumeister in Mannheim, 1652-1689. *Mannheimer Geschichtsbl.*, 32, 203-08, 1931. ISIS

Fischer, Hans. JOHANN JAKOB WEPFER, 1620-1695. Ein Beitrag zur Medizingeschichte des 17. Jhdts. 109 p., 1 port. (*Mitt. d. Naturforsch. Ges. Schaffhausen*, H. 9, 93-201, 1929-30). Zürich, RUDOLF, 1931. ISIS

Franklin, K. J. The work of RICHARD LOWER (1631-1691). *Proceedings of the Royal Society of Medicine*, 25, 113-18, 1931. ISIS

The tercentenary of LOWER's birth has brought forth three important contributions from FRANKLIN: (1) this brief review of LOWER's place in the Oxford group with WILLIS, BOYLE, WREN, MAYOW and others; the large part played by LOWER in the writing of WILLIS' *Cerebri Anatome*; the importance of LOWER's *De Corde*; (2) Notes on variations in the editions of *De Corde* (*Annals of Med. Hist.*, 3, 599, 1931); (3) a facsimile edition of *De Corde* with a biographical notice (GUNTHER's *Early Science in Oxford*, vol. 9, Oxford, 1932). H. R. V.

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E. — *Alia*

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XVIIIth Century (whole and first half)

A. — *Mathematics*

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B. — *Physical sciences and technology*

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XVIIIth Century (second half)

A. — *Mathematics*

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"'In a given triangle inscribe three circles each tangent to two sides of the triangle and to the other two circles.' This is known as 'MALFATTI's problem.' Many years earlier JEAN BERNOULLI (1667-1748) solved the particular case when the triangle was isosceles (J. BERNOULLI, *Opera*, Geneva, v. 1, 1744, p. 303)." GIANFRANCESCO MALFATTI (1731-1807) published that problem in 1803. G. S.

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B. — *Physical sciences and technology*

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"PRIESTLEY was a dissenter in religion and a democrat in politics at a time when these beliefs were unpopular. In his speeches, pamphlets, sermons, and books (except scientific books) he aroused the opposition of leaders in both church and state. Moreover, he was disputatious by nature, not violent, but persistent. He nagged his opponents. Hence he was constantly subjected to persecution, especially during the last twenty years of his life. After the riots in Birmingham, the persecution became so discomforting and unbearable that he emigrated from England to America. However, he did not change his views on religion and, especially, on politics, nor did he modify his methods of expression. Hence he was persecuted in the 'land of the free.' This paper gives an account of a vicious attack on 'the honest heretic' by an English refugee named WILLIAM COBBETT (1762-1835), who accomplished his purpose by writing a pamphlet under the pen-name of PETER PORCUPINE."

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JEAN ANTOINE CHAPTAL (1756.05.04 - 1832.07.30) fut, quoiqu'en veuille son biographe, plus un vulgarisateur qu'un savant, mais il sut être un excellent industriel, un admirable organisateur pour ses propres industries chimiques, pour celles qu'il dut créer pour la Convention, et un parfait homme d'état dans les fonctions qui lui furent confiées par l'Empire et par la Restauration ensuite. Ses principaux ouvrages sont : *Éléments de chimie*, 3 vol. 1790; *Chimie appliquée aux arts*, 4 vol. 1807; *L'art de faire le vin*, 1801, 1819; *Chimie appliquée à l'agriculture*, 2 vol. 1819; de nombreux mémoires de chimie industrielle ont été par lui publiés, surtout aux *Annales de chimie* et aux *Mémoires de l'Institut*. L'ouvrage que vient de lui consacrer JEAN PIGEIRE à l'occasion du centenaire de sa mort est une excellente biographie à laquelle il a incorporé adroitement de nombreux fragments de lettres, de rapports, de procès-verbaux de CHAPTAL. L. G.

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(Scheele). The collected papers of CARL WILHELM SCHEELE. Translated from the Swedish and German originals by LEONARD DOBBIN. XVI+367 p. London, BELL, 1931. ISIS

Dr. DOBBIN, in making this book, has devoted himself first to SCHEELE and next to the reader. He has used his great knowledge of SCHEELE in collecting and translating these papers : further in giving an introduction, two appendices and an index, each of them helpful. An index may be made in a perfunctory way and yet be useful; this one is excellent.

Here we have SCHEELE's contributions to chemistry in many fields and nothing omitted. We have much more. We find him repeating the cardinal experiments of the new chemistry using a cunning technique of his own; for instance, the production of water from hydrogen and oxygen. SCHEELE, when this or that chemist had been unable to repeat his experiments, professed concern and explained what must have gone wrong. That kind of thing, of course, is to be done politely. He did it politely and gleefully. We find also his judgments on the work and the doctrines of BLACK, MEYER, PRIESTLEY, CAVENDISH, LAVOISIER; even personal opinions on one and another of these men.

SCHEELE's early work, that on tartaric acid—published not by him but by RETZIUS—and that on fluor spar, soon drew the attention of LAVOISIER and of BLACK. LAVOISIER sent him a copy of the *Opuscules physiques et chimiques;* BLACK, in his lectures, related the work with commendation.

It is to be hoped now that someone, taking up the study of SCHEELE, will produce an intimate account of his work and of his relations with contemporary men of science. One would like to know about his relations with BERGMAN, for instance, who is said to have been the means of delaying the publication of his book on *Air and Fire*. BERGMAN, in order to satisfy himself that SCHEELE's experiments were not wrong, must needs repeat them. Being satisfied, he contributed an introduction to the book—something long-winded about the great importance of chemistry—which is a foil to the experiments of SCHEELE and to the joy that he felt in making them and describing them.

A. N. MELDRUM.

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Answer by MELDRUM, *ibidem*, p. 252.

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Winderlich, R. Die WOULFEsche Flasche. *Chem.-Ztg.*, 56, 681, 1932. ISIS

Apropos of PETER WOULFE (1727?-1803), inventor of " WOULFE's bottle."

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C. — *Natural sciences*

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XIXth Century (whole and first half)

A. — *Mathematics*

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Carl Friedrich Gauss Werke. Herausgegeben von der Gesellschaft der Wissenschaften zu Göttingen, vol. 10, part 2, Memoirs 2 (by LUDWIG SCHLESINGER) and 3 (by ALEXANDER OSTROWSKI), Berlin, 1933. 222+18 p. ISIS

During the years 1911-20 were published eight Hefte with the general heading *Materialien für eine wissenschaftliche Biographie von Gauss;* these were in large octavo format. Four of these and part of a fifth (1, 3, 5, 6, 8) have now been revised and enlarged (as Memoirs, 1 2, 4, 6, 3), and issued (1922-23) in the quarto format of volume 10 part 2 of the *Werke* of GAUSS. A new memoir (5) by O. BOLZA, not in *Materialien*, on "GAUSS und die Variationsrechnung" (95 p.), appeared in 1922. BRENDEL's "Über die astronomischen Arbeiten von GAUSS" was a great elaboration (1929, 258 p.) of number 7 of the *Materialien* (1919, 106 p.) and appeared in volume 11, part 2 of the *Werke*. Each memoir is independently paged.

SCHLESINGER's memoir (2) has been much expanded. The original 105 pages have become 210; Sachregister and Namenregister have been added, as well as Berichtigungen for parts of earlier volumes dealing with GAUSS's work in the theory of functions. OSTROWSKI's "Essay," also elaborated, is entitled: "Über den ersten und vierten Gaussischen Beweis des Fundamentalsatzes der Algebra." All the memoirs of this series are very interesting and valuable.

The following numbers of *Materialien* have not yet been reprinted: 2. L. SCHLESINGER, "C. F. GAUSS: Fragmente zur Theorie des arithmetisch-

geometrischen Mittels aus dem Jahren 1797-1799"; 4. A. GALLE, "C. F. GAUSS als Zahlenrechner"; 8. A. FRAENKEL, "Zahlbegriff und Algebra bei GAUSS" (49 p., with "Anhang" by OSTROWSKI, p. 50-58, reprinted above). R. C. A.

Loria, Gino. A. L. CAUCHY in the history of analytic geometry. *Scripta mathematica*, 1, 123-28, 1932. ISIS

Roy, René. COURNOT et l'école mathématique. *Econometrica*, 1. 13-22, 1 port., 1933. ISIS

« L'œuvre économique de COURNOT comprend seulement deux ouvrages : (1) *Recherches sur les principes mathématiques de la théorie des richesses*, publié en 1838, et (2) *Principes de la théorie des richesses* publié en 1863. Le second ouvrage ne contient d'ailleurs aucun développement mathématique et reprend, en les complétant, les idées exposées dans le premier; celui-ci contient donc en substance tous les éléments des problèmes traités par COURNOT. »

Simons, Lao Genevra. A mathematical publication of 1834. *Scripta mathematica*, 1, 129-31, 1932. ISIS

Journal of the Institute at Flushing.

Wietzke, A. Das wieder aufgefundene Jugendbild von CARL FRIEDRICH GAUSS. *Jahresbericht der deutschen Mathematiker-Vereinigung*, 41, *1-2*, frontispiece, 1931. ISIS

A fine portrait painted by CHRISTIAN AUGUST SCHWARZ when GAUSS was 26 years old and given by GAUSS to his friend WILHELM OLBERS. In 1928, the picture was found in the hands of a descendant by whom it was presented to the Observatory at Göttingen in 1929. R. C. A.

Zemaitis, Z. N. I. LOBATSCHEWSKY und seine Verdienste um die nichteuklidische Geometrie. *Kosmos*, 12, 212-16, Kaunas, 1931 (Litauisch). K. V. ISIS

B. — *Physical sciences and technology*

Bragg, W. H. FARADAY's diary. *Rev. Mod. Physics*, 3, 449-64, 1931. ISIS

(Carnot, Sadi). Une commémoration de Sadi Carnot au Petit-Luxembourg. By EMILE PICARD, *Revue générale des sciences*, 43, 625-26, 1932. ISIS

Lippmann, Edmund O. von. Vor hundert Jahren (Nr. XII). *Die Deutsche Zuckerindustrie*, S. 29 ff., Berlin, 1933. ISIS

Apropos of M. DE MONTVÉRAN : Essai sur la statistique (Paris 1833). G. S.

Ludendorff, H. MENZELS Sternkarte. Zu ihrem bevorstehenden 100. Geburtstage. *Philobiblon*, 4, 427-28, 1931. ISIS

Magie, W. F. JOSEPH HENRY (1797-1878). *Rev. Mod. Physics*, 3, 465-95, 1931. ISIS

Notice biographique et résumé chronologique des travaux de ce physicien. J. P.

Mitkewich, W. Th. The work of FARADAY and modern developments in the application of electrical energy. 4 p. Science at the Cross Roads, London, Kniga, 1931. ISIS

(Prout). PROUT'S hypothesis. Papers by WILLIAM PROUT (1815-16), J. S. STAS (1860) and C. MARIGNAC (1860). 58 p. (Alembic Club reprints, no. 20). Edinburgh, OLIVER and BOYD, 1932. ISIS

Most readers of a scientific memoir that is important enough to be reprinted need guidance if they are to understand it in all its bearings. The Alembic Club, in giving an historical introduction to this reprint, has made a departure from its traditions that is greatly to be welcomed. The introduction shows the varied fortunes of PROUT'S hypothesis in its particular and its general form; it gives innumerable references to chemical literature one of which belongs to the year 1932. GAY-LUSSAC'S law, concerning the combining volumes of gases, within about three years from its announcement, led to AVOGADRO'S hypothesis and within about three years more, to PROUT'S hypothesis. PROUT was a medical man who sought to keep up with the progress of chemistry. He graduated M. D. at Edinburgh University in the year 1811. He probably attended the lectures on chemistry that were given by HOPE but not late enough, one would judge, to hear of GAY-LUSSAC'S law in them. A. N. M.

Verebélij, L. de. ANYOS JEDLIK : a Hungarian pioneer of electricity. *Elektrotechnika*, p. 213, NOV. 15, 1931. ISIS

JEDLIK was born January 11th, 1800 at Szémö (County of Komárom), Hungary, "from simple and poor farmers." Became a Benedictine friar in his 17th year, and was ordained priest in 1825. He taught physics first at Pannonhalma and then at Györ. Went to the Academy of Pozsony in 1830. Was made professor at the University of Pest in 1840, and occupied the chair of physics for 38 years, when he retired. Although we are told that JEDLIK, like FARADAY, lacked mathematical training, he was an accomplished experimenter, and made numerous valuable contributions to science. The two most important of these were the electromagnetic rotor and the unipolar inductor, which are described in detail by Prof. DE VEREBÉLIJ in the above paper. It appears that with these inventions JEDLIK anticipated by some six years the work of SIEMENS and WHEATSTONE in producing mechanical rotary motion by electrical means.

It follows that JEDLIK holds an important position in the history of electrical development. This importance does not appear to have been generally

recognized, and it is suggested that a study of JEDLIK's work in the light of contemporary developments would be of considerable interest.

G. WINDRED.

C. — *Natural sciences*

Holmes, S. J. A forgotten evolutionist. *Science*, 77, 48-49, 1933. ISIS

" On looking through the volumes of the shortlived *Archiv für Zoologie und Zootomie* my attention was attracted to an article (Bd. III, p. 167, 1802) entitled ' Ueber den ursprünglichen Stamm des Menschengeschlechts,' by D. SCHELVER." " While his evolutionary concepts have much of the vagueness that characterizes the speculations of the earlier transformists, it is clear that he regards man as having a common origin with the higher apes, and that the higher types of animals are derived from lower ones, as is indicated by his reference to the genealogical table of organic life, ' der Stammtafel der ganzen lebenden Schöpfung,... die bis an das erste punctum saliens alles Lebens zurückführet '."

Mourgue, Raoul. La conception de la biologie chez GOTTFRIED REINHOLD TREVIRANUS (1776-1837). *Journal of Comparative Neurology*, 56. 503-10, 1932. ISIS

" En 1802 TREVIRANUS publiait sous le titre absolument nouveau pour l'époque de ' Biologie oder Philosophie der lebenden Natur für Naturforscher und Aerzte ' un ouvrage dont le sixième et dernier volume devait paraître vingt ans plus tard. Cette expression de *Biologie*, à laquelle l'avenir devait donner la formidable diffusion que l'on sait, était introduite simultanément en France par le naturaliste LAMARCK; mais, à notre avis, c'est incontestablement à TREVIRANUS que revient l'honneur d'avoir donné, pour la première fois, de la biologie un programme méthodologique qu'il n'est pas inutile, aujourd'hui encore, d'évoquer."

Schroeder van der Kolk, J. L. C. Over het verschil tusschen doode natuurkrachten, levenskrachten en ziel. Ueber den Unterschied zwischen todten Naturkräften, Lebenskräften und Seele. Niederländische Text einer Rede ausgesprochen 1835 zu Utrecht. Deutsche Uebersetzung von J. F. H. ALBERS, Bonn, 1836. *Opuscula selecta Neerlandicorum De arte medica*, Fasc. XI, Amsterdam, *Nederlandsch Tijdschrift voor Geneeskunde*, 1932, p. 283-359, pl. ISIS

A classic of vitalistic literature reprinted in the Dutch original and in contemporary German translation. Author's portrait. G. S.

Tesdorpf, Paul Hermann. ALEXANDER VON HUMBOLDT und seine Bedeutung für die Geistes- und Natur-Wissenschaften. *Allgemeine Rundschau*, 30, 102-04, Febr. 1933. ISIS

Vortrag gehalten am 7. Januar 1933 in einer Sonder-Versammlung der

Münchener Vereinigung für Geschichte der Naturwissenschaften, Medizin und Technik.

D. — *Medical sciences*

Brunschwig, Alexander. JEAN FRÉDERIC LOBSTEIN, the first professor of pathology. *Annals of Medical History*, 5, 82-84, 1 fig., 1933. ISIS

" JEAN FRÉDERIC LOBSTEIN (1777-1835) is entitled to a place in medical history because he was the encumbent of the first chair of pathology established in a faculty of medicine and because it was he who coined the words ' arteriosclerosis ' and ' arteriectasia '."

Civinini, Filippo (Nepos). Una lettera inedita del Prof. GIOVANNI GORGONE a FILIPPO CIVININI. *Riv. di storia d. sc. med. e natur.*, 170-73, 1932. ISIS

GIOVANNI GORGONE (1801-1868); FILIPPO CIVININI (1805-1844).

Fürth, Ernst. Eine Chirurgenreise vor 90 Jahren. Aus hinterlassenen Tagebüchern zusammengestellt. *Sudhoffs Archiv für Geschichte der Medizin*, 26, 30-46, 1933. ISIS

Apropos of CARL LUDWIG SIGMUND's travels in Germany, France and England in 1840-42. SIGMUND was later professor of sexual diseases in Vienna. G. S.

Haendcke, E. Beiträge zur Hygience in der Armee NAPOLEONS I. *Sudhoffs Archiv für Geschichte der Medizin*, 26, 47-64, 1933. ISIS

Klaauw, C. J. van der. The scientific correspondence between Professor JAN VAN DER HOEVEN and Professor RICHARD OWEN. *Janus*, 36, 327-51, 2 portr., 1932. ISIS

C. J. VAN DER HOEVEN (1801-1868); RICHARD OWEN (1804-1892).

McKenzie, Dan. ALFRED HIGGINSON and his syringe: with a side-glance at the clyster. *Proceedings of the Royal Society of Medicine*, 25, 633-38, 1932. ISIS

The author reviews the history of instruments used before HIGGINSON's time in giving clysters or enemata to evacuate the lower bowel. HIGGINSON (1808-1884), combining the advantages of previous syringes, invented the rubber enema-syringe known as " the English syringe." The exact date of his original description is unknown. This ingenious surgeon, who practiced in Liverpool, also devised a blood transfusion apparatus, an ether inhaler and a stomach pump. H. R. V.

Miller, William Snow. WILLIAM BEAUMONT, M. D. (1785-1853). *Annals of Medical History*, 5, 28-51, 14 fig., frontispiece, 1933. ISIS

Neveu, Raymond. La vie et l'œuvre de CARLO BOTTA, recteur de l'Académie de Rouen (1766-1837). *Bull. de la société franç. d'histoire de la médecine*, 26, 409-12, 1932. ISIS

Trénel, M. Sur une lettre de LARREY demandant des honoraires pour soins donnés à l'ambassadeur de Perse (1808). *Bulletin de la société française d'histoire de la médecine*, 26, 326-32, 1932. ISIS

Trénel, M. Une proposition de LARREY d'embaumer les pairs de France. *Bulletin de la société française d'histoire de la médecine*, 26, 324-25, 1932. ISIS

XIXth Century (second half)

A. — *Mathematics*

Archibald, R. C. LEWIS CARROLL bibliographies. *Scripta mathematica*, 1, 172-73, 1932. ISIS

(Bianchi, Luigi). KRYLOFF, NICOLAS. LUIGI BIANCHI (1856-1928). *Bull. Acad. Sc. URSS.* Sér. 7, 855-58, 1929. (Russian). ISIS

Cantor, Georg. Gesammelte Abhandlungen mathematischen und philosophischen Inhalts mit erläuternden Anmerkungen sowie mit Ergänzungen aus dem Briefwechsel CANTOR-DEDEKIND. Hrsg. von ERNST ZERMELO nebst einem Lebenslauf CANTORS von ADOLF FRAENKEL. VII+486 p., port., 1932. ISIS

Reviewed by A. A. BENNETT, *American Mathematical Monthly*, 40, 103, 1933.

Carroll, Lewis. Catalogue of an exhibition to commemorate the one hundredth anniversary of the birth of LEWIS CARROLL. (CHARLES LUDWIDGE DODGSON) 1832-1898. VI+154 p., 3 pl. New York, Columbia University Press, 1932. ISIS

This is a catalogue of the Exhibition held in the Avery Library, Columbia University, in April 1932. Of the 1500 copies of the Catalogue offered for sale at 35 cents, 95 copies were bound in red cloth, numbered, and offered for sale at $ 5.00. The contents of the catalogue are arranged under the following headings: The " Alice " books (nos. 1-43), translations of the " Alice " books (44-73), miscellaneous works (74-95), mathematical works (96-125), works on logic (126-50), pamphlets and leaflets (151-221), games and puzzles (222-42), plays based on the " Alice " books (243-53), music (266-74), Carrolliana (275-341), special exhibits (342-90), autograph manuscripts and letters (391-415), index. Item number 1, the original ms. of " Alice's adventures under ground," written in 1886, was sold in 1928 to ROSENBACH of Philadelphia for £ 15,400, a record price for a book at an

auction in Great Britain. In the same year he sold it for £ 30,000 to ELDRIDGE R. JOHNSON of Morristown, N. J.

As indicated above, the exhibit contained 415 items of which 30 were mathematical. Chief among these are DODGSON's works on arithmetic, EUCLID, algebraical geometry, plane trigonometry, determinants, and pillow-problems.

Mrs. HARGREAVES, LEWIS CARROLL's 'Alice,' is still living and came from England to see the Exhibition. Columbia University conferred on her the honorary degree of Master in Arts. R. C. A.

De La Mare, Walter. LEWIS CARROLL, 67 p. London, FABER and FABER, 1932. ISIS

This is the finest sketch of LEWIS CARROLL written up to the present and it is here reprinted from pages 218-55 of *The Eighteen-Eighties. Essays by Fellows of the Royal Society of Literature*, ed. by W. DE LA MARE, Cambridge University Press, 1930. R. C. A.

Eberhard, Victor (1861-1927). VICTOR EBERHARD, by A. ROSENTHAL, in *Jahresbericht der deutschen Mathematiker-Vereinigung*, 41, 40-49, portrait, 1931. ISIS

VICTOR GUIDO FEODOR EBERHARD was born 17 January 1861 in Pless, Schlesien, and died at Halle a. S., 28 April 1927. From his thirteenth year he was totally blind but nevertheless prepared himself for the University of Breslau where he took his doctor's degree in mathematics in 1885 for a dissertation *Über eine räumlich involutorische Verwandtschaft 7. Grades und ihre Kernfläche 4. Ordnung*. In 1891 appeared his book *Zur Morphologie der Polyeder* and in 1895 his volume on *Die Grundgebilde der ebenen Geometrie*. From 1895-1926 (the date 1904 in "Poggendorff" is incorrect) he was an active professor of mathematics at the University of Halle. R. C. A.

Green, Rufus, Lot. (Rush County, Indiana, 1862 — Palo Alto, California, 1932). Professor of mathematics in Stanford University. Obituary by FREDERICK E. BRASCH, *Science*, 77, 11-12, 1933. ISIS

Madan, F. The LEWIS CARROLL centenary in London, 1932. Including a catalogue of the Exhibition, with notes; an essay on DODGSON's illustrators by HAROLD HARTLEY; and additional literary pieces (chiefly unpublished). With six illustrations. XX+149 p., 6 pl. London, BUMPUS, 1932. ISIS

This beautiful bound volume on thick paper, and selling for less than a dollar, differs from the unbound edition in price (less than 20 cents), in quality of paper, in lacking five of the above mentioned six plates, and the 24 pages of "literary pieces." There were 643 items in the most excellent exhibit. The catalogue is admirably edited and much more interesting than the American catalogue. The signed notes by F. M. = F. MADAN, and S. H. W. = S. H. WILLIAMS added to many of the entries are especially illuminating.

R. C. A.

Peano, Guiseppe. (1858-1932) Obituary by MARIO GLIOZZI, in *Archeion*, 14, 254-55, 1932. ISIS

Williams, S. H.; Madan, F. A handbook of the literature of the Rev. C. L. DODGSON (LEWIS CARROLL). XXIV+336 p., 16 pl. Oxford, University Press, 1931. ISIS

This invaluable work is a development of A bibliography of the writings of LEWIS CARROLL (CHARLES LUTWIDGE DODGSON, M. A.), by S. H. WILLIAMS (London, 1924, XIV+142 p.). It is far more than a bibliography, although in this respect it is extraordinarily complete, listing, for example, the translations into Braille, Chinese, Dutch, Esperanto, French, German, Hebrew, Hungarian, Irish, Italian, Norwegian, Russian, shorthand, Spanish, and Swedish; a Czech translation has recently appeared. It contains also (p. 193-222) "Selected short pieces by him, printed for the first time or reprinted; and notes on unpublished matter." It lists also "Memoirs, reminiscences, memorials, bibliographies" (p. 243-55); "Portraits" (p. 256-62); "Dramatization and musical settings" (p. 263-81); "Abridgements, extracts, retellings, etc." (p. 282-86); "Parodies, imitations, miscellanea" (p. 287-309); "A few notes on the chief collections of Carrolliana" (p. 310-12). There is also a great deal of biographical and other miscellaneous material of much interest. R. C. A.

B. — *Physical sciences and technology*

Chapman, A. Chaston. The growth of the profession of chemistry during the past half-century (1877-1927). 23 p. The Institute of Chemistry of Great Britain and Ireland, London, 1927. ISIS

Doublet, E. Les observatoires du Parc de Montsouris. *Revue scientifique*, 70, 20-22, 1932. ISIS

L'observatoire météorologique du Parc de Montsouris fonctionne depuis 1869 et fut rattaché en 1872 au grand observatoire de Paris. L'observatoire astronomique s'occupe surtout d'astronomie de position et de la détermination des positions géographiques. L. S.

Feldhaus, F. M. Der Erfinder des Mikrophons, ein Deutscher. *Der Jungdeutsche*, Berlin, Nov. 30, 1932. ISIS

Das Mikrophon wurde vor DAVID EDWARD HUGHES von dem Berliner Physiker ROBERT LÜDTGE erfunden. LÜDTGE ist am 11.9.1845 in Berlin geboren. Er starb am 21.9.1880 in Neuendorf bei Potsdam. Die Erfindung stammt von 1877. Am 11. Jan. 1878 meldete LÜDTGE sie in Berlin zum Patent an. Das Patent trägt die Nummer 4000. HUGHES zeigte seinen Apparat erst am 9. Mai 1878 in London. Mit Rücksicht auf das deutsche Patent von LÜDTGE bekam HUGHES in Deutschland kein Patent auf das Mikrophon. LÜDTGE unterhielt in Berlin ein physikalisches Institut mit Ausstellungsräumen für allerlei Neuerungen. F. M. F.

Lodge, Sir Oliver. Past years, an autobiography. 364 p., 13 pl. New York, SCRIBNER, 1932 ($ 3.50). ISIS

The career of this eminent physicist started with reading the writings of FARADAY, listening to the lectures of TYNDALL, and self education for the University. He confesses to a youthful interest in " the imponderables " and to analytical modes of thought and experimental methods of work. His educational work is linked with the Universities at Liverpool and Birmingham. He joined the faculty of the University of Liverpool in 1871 as professor of experimental physics, equipped its first laboratory in that field, and continued there till 1900, when he became Principal of the University of Birmingham. His public activities contributed greatly to the success of the British Association for the Advancement of Science. He was one of the founders of the Physical Society of London and a leader in the Society for Psychical Research. His researches at Liverpool concerned dust-free spaces and dust control, the storage battery, the coherer principle, electric waves, electric spark ignition, ionization, photoelectric discharge, and the relations of ether to the velocity of light. His researches on radiation and the relations of matter and the ether won for him the Rumford Medal in 1899. A useful chronological table (p. 234) of salient dates about ether waves and their application traces the growth of knowledge from CLERK MAXWELL's paper in 1864 to the establishment of the British Broadcasting Company in 1922. Throughout his life he was interested in psychic phenomena and took an active part in the investigations of telepathy and spiritism along with F. W. H. MYERS and CHARLES RICHET. C. A. K.

C. — *Natural sciences*

Bauer, Louis Agricola (1865-1932). Obituaries by J. A. FLEMING in *Science*, 75, 452-54, 1932 ; by the same in *Gerlands Beiträge zur Geophysik*, 37, 129-30, 1932. Special number of *Terrestrial Magnetism*, vol. 37, no. 3, Sept. 1932, devoted to his memory. G. S. ISIS

Brandegee, Townshend Stith (1843-1925) and **Brandegee, Mary Katharine Layne Curran** (1844-1920). American botanists, man and wife. Obituaries by WILLIAM ALBERT SETCHELL, *University of California Publications in Botany*, 13, 155-78, 2 pl., 1926. ISIS

Caullery, Maurice. EMILE MAUPAS (1842-1916). *Revue scientifique*, 70, 405-07, 1932. ISIS

Discours prononcé à Alger, le 6 avril 1932, à l'occasion de la pose d'une plaque commémorative sur la maison habitée par EMILE MAUPAS. (Médaille de MAUPAS, *Isis*, 14, 417).

Collins, Frank Shipley (Boston, 1848 ; New Haven, Conn., 1920). American algologist. Obituary by W. A. SETCHELL, *American Journal of Botany*, 12, 54-62, 1925. ISIS

(Farlow, William Gilson). WILLIAM GILSON FARLOW (1844-1919). Obituary by WILLIAM ALBERT SETCHELL, 18 pl., portr. *Memoirs of the National Academy of Sciences*, 21, 1927. ISIS

(Huxley). Imperial College of Science and Technology: Huxley memorial lectures, 1925-1932. III+12+30+38+27+16+21+28 p. London, MACMILLAN, 1932. ISIS

Reviewed in *Nature*, 130, 721, 1932.

Raguin, E. PIERRE TERMIER, 1859-1930. 95 p. Paris, DUNOD, 1932. ISIS

Wassermann, Jacob. Bula Matari. STANLEY — conqueror of a continent. Translated from the German by EDEN and CEDAR PAUL. XVI+357 p., 8 pl., 1 map. New York, LIVERIGHT, 1933 ($ 3.00). ISIS

The life of this masterful explorer by the German biographer is based upon STANLEY's various books of travel and his autobiography. It is illumined by a penetrating analysis of his character and motives which carried him through staggering difficulties and monotonous hindrances of tropical forests, enervating fever, and treachery and failure of helpers and subordinates. As an explorer STANLEY was more interested in his project and in people than in fauna and flora, though his biographer pays high tribute to the accuracy and completeness of his accounts of the tropical forest. His contributions to the exploration of tropical Africa were epoch making. He solved the secret of the Congo, started the political movement which led to the Congo Free State under Belgian control, opened the Dark Continent to the mastery of the white race, and by this wiped out the last stronghold of negro slavery fostered by the Arab. C. A. K.

D. — *Medical sciences*

Compton, Piers. The genius of LOUIS PASTEUR. X+361 p., 8 pl. New York, MACMILLAN, 1932 ($ 4.50). ISIS

This biography admirably presents the humanitarian aspects of PASTEUR's work and his great services to the agriculture and industries of France, to medicine and to surgery. Opposition to Darwinism and to evolution is expressed and much is made of the criticisms and attacks which the ideas of this great bacteriologist aroused and which he successfully combated. This feature of the book is its main contribution, though not documented. C. A. K.

Diasio, Fortunato A. DOMENICO MAJOCCHI (1849-1929), a biographical appreciation. *Medical Life*, 39, 597-601, 1 port., 1932. ISIS

Grassmück, J. Zur Geschichte der Pestepidemie in Kolobowka bei

Zarew, Gouvernement Astrachan im Jahre 1899. *Sudhoffs Archiv für Geschichte der Medizin*, 26, 65-72, 1933. ISIS

Guillain, Georges. J. BABINSKI (1857-1932). 19 p., portr. Paris, MASSON, 1932. ISIS

Notice nécrologique extraite de la *Presse Médicale*, N° 51, 12 nov. 1932, sur le maître incontesté de la physiologie et de la pathologie du système nerveux, en France. L. G.

Landis, H. R. M. The reception of KOCH's discovery in the United States. *Annals of Medical History*, 4, 531-37, 1932. ISIS

Michaelis, E. FREUD, son visage et son masque ; trad. de l'allemand par V. JANKÉLÉVITCH. 256 p. Paris, RIEDER, 1932. ISIS

Rolleston, J. D. Sir BENJAMIN WARD RICHARDSON, his life and work. *Janus*, 36, 361-83, 1932. ISIS

BENJAMIN WARD RICHARDSON, 1828-1896.

Sigerist, Henry E. EMILE LITTRÉ on CHARLES DAREMBERG. *Medical Life*, 39, 593-96, 2 port., 1932. ISIS

Smith, Theobald. KOCH's views on the stability of species among bacteria. *Annals of Medical History*, 4, 524-30, 1932. ISIS

Webb, Gerald B. ROBERT KOCH (1843-1910). *Annals of Medical History*, 4, 509-23, 3 fig., 1932. ISIS

E. — *Alia*

Bertram, Ernst. NIETZSCHE. Essai de mythologie. Traduit de l'allemand sur la septième édition par ROBERT PITROU. 470 p., Paris, RIEDER, 1932. ISIS

Cet ouvrage sur NIETZSCHE, écrit vers 1917, et que son auteur présente comme un « Essai de mythologie » n'est ni une biographie, ni un exposé de doctrine, mais un monument symbolique (l'introduction s'ouvre par cette phrase « Tout ce qui fut n'est que symbole ») élevé à la gloire de NIETZSCHE. Certains titres de chapitres montreront peut-être l'esprit dans lequel est conçue l'œuvre de BERTRAM : Arion « semblable à l'Arion de la légende antique chez HÉRODOTE, seule,.. la puissance de son chant intérieur (le chant intérieur de NIETZSCHE) le maintenait encore, tel un dauphin secourable, au-dessus des vagues » (p. 164); Philoctète; Judas (le Judas qui trahit pour que s'accomplisse l'œuvre de rédemption, grâce à son horrible sacrifice); Napoléon (« non pas Bonaparte, mais Napoléon-César », « Napoléon, synthèse d'inhumain et de surhumain »); Claude Lorrain, Socrate, etc. L. G.

Bragman, Louis J. WALT WHITMAN, hospital attendant and medical critic. *Medical Life*, 39, 606-15, 1932. ISIS

Cochet, Marie Anne. NIETZSCHE d'arpès son plus récent interprète français. *Rev. philosophique*, 57, 219-75, 1932. ISIS

Sur les écrits de CHARLES ANDLER : NIETZSCHE, sa vie et sa pensée. I. Les précurseurs, 1920; II. La jeunesse de N., 1921; III. Le pessimisme esthétique et la philosophie de l'illusion, 1922; IV. La maturité de N., 1928; V. Le transformisme intellectualiste, 1922; VI. La dernière philosophie de N., 1931, 5 vol., Paris, BOSSARD. Sur le même sujet, une autre étude du même auteur à la *Rev. de métaphysique et de morale*, 38, 613-41, 1931; voir aussi GENEVIÈVE BIANQUIS : NIETZSCHE, sa vie et sa pensée (d'après M. CHARLES ANDLER), *Journal de psychologie*, 29, 146-53, 1932. L. G.

Colman, E. Short communication on the unpublished writings of KARL MARX dealing with mathematics, the natural sciences and technology, and the history of these subjects. 3 p. Science at the Cross Roads, London, KNIGA, 1931. ISIS

Oliver, John Rathbone. The Promethean fantasies of SCRIABINE. *Bulletin of the Institute of the History of Medicine*, The Johns Hopkins University, 1, 31-40, 1933. ISIS

Taylor, Monica. Sir BERTRAM WINDLE, a memoir. XVI+428 p., 4 pl. London, LONGMANS, GREEN, 1932 ($ 4.00). ISIS

Sir BERTRAM COGHILL ALAN WINDLE (1858-1929) played a leading part in the creation of Birmingham University and the National University of Ireland. From 1920 he was associated with St. Michael's College of Toronto University. He is the author of over twenty books in the fields of British archaeology, evolution, history of science, and Catholic philosophy and apologetics. Among these are *Religions, past and present* (1927); *Chester* (1903); *Remains of a prehistoric age in England* (1904); *Twelve Catholic men of science* (1912); *A century of scientific thought* (1915); *Vitalism and scholasticism* (1919); *The Megalith builders* (1926); and *Catholic Church in its reactions to science* (1927). This biographer skillfully uses his extensive and brilliant correspondence to portray the workings of a facile and versatile intellect. C. A. K.

Vialle, Louis. Détresses de NIETZSCHE. VIII+156 p. Paris, ALCAN, 1933. ISIS

Cette étude prolonge l'essai du même auteur : *Le désir du néant* (voir cette même bibliographie, sous 37 Psychology). Elle en illustre la thèse, non par une biographie de NIETZSCHE, ou par un exposé objectif de doctrines, mais en mettant en lumière le fait que « l'œuvre de NIETZSCHE est, plus manifestement que toute autre, l'expression d'une lutte pour vaincre de douloureuses hantises », le fait que ses livres « sont les confessions plus ou moins conscientes d'une sensibilité anxieuse qui s'évertue à sortir de sa détresse ». L. G.

Walz, Georges. La vie de FRÉDÉRIC NIETZSCHE d'après sa correspondance. Textes choisis et traduits par GEORGES WALZ avec une préface biographique. 568 p., Paris, RIEDER, 1932. ISIS

Le choix qu'a fait GEORGES WALZ dans la correspondance de NIETZSCHE pour essayer d'en dégager sa figure humaine « avec sa force et ses faiblesses, ses joies et ses désespoirs », ne peut certes que contribuer à mieux faire comprendre comment ce « petit professeur en retraite, aux trois quarts aveugle, malhabile en face des nécessités de l'existence, a ressenti comme nul autre dans sa chaumière de Sils-Maria et sous le toit de sa mansarde de Gênes les détresses de l'humanité et voulu lui donner une loi nouvelle, » et comment il en avait le droit, par la pureté de sa vie, sa noblesse d'âme et son invraisemblable clairvoyance. Avant les extraits de lettres (plus de 260) que relient des extraits des écrits autobiographiques de NIETZSCHE, WALZ donne une biographie du philosophe et des indications biographiques sommaires sur ses principaux correspondants. Tables et index excellents. L. G.

XXth Century

A. — *Mathematics*

(Gronwall, Th. H., 1877-1932). THOMAS HAKON GRONWALL — In memoriam. By EINAR HILLE. *Bulletin Amer. Math. Soc.*, 38, 775-86, 1932. ISIS

The sketch of GRONWALL's life is followed by a summary account of his scientific production grouped, according to subjects, under thirteen headings covering various fields of pure and applied mathematics. " After this survey let us try to analyze GRONWALL as a scientific writer. The first impression is undoubtedly that of bewildering versatility. A closer examination reveals, however, that there is much more unity in this work than is apparent at first sight. GRONWALL was first and last an analyst, but he frequently went to other fields for questions to turn into analytical problems. His command of the classical tools of analysis was superb; he worked in practically all the main fields of analysis and left a mark for himself in several." The appended bibliography lists his 85 published papers, and the abstracts of 24 unpublished papers—results of investigations communicated to the American Mathematical Society. An inventory of GRONWALL's posthumous papers would be a valuable addition to this biobibliography. A. P.

(Moore, Clarence Lemuel Elisha). CLARENCE LEMUEL ELISHA MOORE (1876-1931). Obituary by PHILIP FRANKLIN, in *Proceedings of the American Academy*, 606-08, (undated, received March 1933). ISIS

Müller, Emil (1860-1928). EMIL MÜLLER, by E. KRUPPA, in *Jahresbericht der deutschen Mathematiker-Vereinigung*, 41 (1932), 50-58, portrait, 1931. ISIS

This sketch is essentially an extract from " EMIL MÜLLER's Leben und

Wirken" by the same author in *Monatshefte für Mathematik und Physik*, 35, 197-218, 1928. EMIL ADALBERT MÜLLER was born 22 April 1860 at Landskron, Bohemia and died 1 September 1928 in Vienna where he had been professor of descriptive geometry in the Technische Hochschule since 1902. Both articles contain a list of MÜLLER's 54 publications almost all of them being in the field of geometry. The more substantial items are his *Lehrbuch der darstellenden Geometrie* (vol. 1, 1908, third edition 1920; vol. 2, 1916, third edition, 1923), *Vorlesungen über darstellende Geometrie* (3 vol., ed. by E. KRUPPA and J. L. KRAMES, 1923-29), and "Die verschiedenen Koordinatensysteme," *Encyklopädie der mathematischen Wissenschaften*, v. III-1, H. 4, 596-770, 1910.

There is another obituary notice of MÜLLER by TH. SCHMID in *Zeitschrift für angewandte Mathematik und Mechanik*, 8, 81-83, Feb. 1928.

R. C. A.

Tamaru, Takuró (1872-1932). Professor TAKURŌ TAMARU, by T. SHINIZU, in *Proceedings of the Physico-Mathematical Society of Japan*, s. 3, v. 14, Oct. 1932. ISIS

Introductory page and frontispiece portrait of TAMARU (25 Sept. 1872—22 Sept. 1932) professor of theoretical physics in the Tokyo Imperial University. R. C. A.

Wilczynski, Ernest Julius. Obituary by ERNEST P. LANE, *American Mathematical Monthly*, 39, 567-69, 1932. ISIS

B. — *Physical sciences and technology*

Ewald, P. P. Zur Entdeckung der RÖNTGENinterferenzen vor zwanzig Jahren und zu Sir W. BRAGGS siebzigsten Geburtstag. *Die Naturwissenschaften*, 20, 527-30, 1932. ISIS

C. — *Natural sciences*

Crosthwait, H. L. Mount Everest. *Nature*, 131, 10-14, 1 fig., 1933. ISIS

Historical account of the efforts to climb it and of the results already obtained. G. S.

D. — *Medical sciences*

(Chauffard, A.) Le Professeur A. CHAUFFARD (1855-1932). Obituary by PAUL LE GENDRE, *Bull. de la société franç. d'histoire de la médecine*, 26, 402-07, 1932. ISIS

(Hervé, Georges). Le Professeur GEORGES HERVÉ (1855-1932). Obituary by PAUL LE GENDRE, *Bull. de la société franç. d'histoire de la médecine*, 26, 397-401, 1932. ISIS

Simson, Sir Henry. The late Sir HENRY SIMSON, by J. C. H. MACBETH. *Medical Life*, 39, 602-05, 1 port., 1932. ISIS

E. — *Alia*

Berliner, Arnold. Zur Feier seines siebzigsten Geburtstages. *Die Naturwissenschaften*, 20, 911 sq., 1932. ISIS

Crexells i Vallhonrat, Joan (Barcelona, 1896—Barcelona, 1926). Miscellania CREXELLS. XV+243 p., port., pl. (Publicacions de la Fundacio Bernat Metge, I). Barcelona, 1929. ISIS

(Heikel, I. A.) Commentationes philologicae in honorem professoris emeriti I. A. HEIKEL. Ediderunt discipuli. VI+163 p., port. Helsinki, 1926. ISIS

(Judeich, Walther). Festschrift WALTHER JUDEICH zum 70. Geburtstag überreicht von Jenaer Freunden. 290 p., portrait, pl. Weimar, BÖHLAUS, 1929. ISIS

Löwy, H. Die Erkenntnistheorie von POPPER-LYNKENS und ihre Beziehung zur MACHschen Philosophie. *Die Naturwissenschaften*, 20, 767-70, 1932. ISIS

(Persson, Per). Strena philologica Upsaliensis. Festskrift tillägnad Professor PER PERSSON på hans 65-Årsdag Nyårsafton 1922. VII+416 p., figs., port. Upsala, 1922. ISIS

(Ramorino, Felice). Raccolta di scritti in onore di FELICE RAMORINO. XXIV+707 p., port., pl. Milano, Vita e Pensiero, 1927. ISIS

(Thomas, Paul). Mélanges PAUL THOMAS. Recueil de mémoires concernant la philologie classique. LXVII+757 p., 4 illus., frontispiece. Bruges, Imprimerie Sainte-Catherine, 1930. ISIS

PART II

HISTORICAL CLASSIFICATION

I. — ANTIQUITY

1. — ANTIQUITY (*generalities*)

Almeida e Vasconcellos, F. De. Historia das matematicas na antiguidade. XXIV+653 p. Paris, AILLAUD et BERTRAND, 1925. ISIS

Reviewed by K. VOGEL, *Mitteilungen zur Geschichte der Med.*, 31, 194, 1932.

Dussaud, René. La serrure de Sour-Baher d'après les recherches de M. CH. FRÉMONT. *Syria*, 6, 188-93, 4 fig., 1925. ISIS

Jean, Charles-F. Les Hyksos sont-ils les inventeurs de l'alphabet? *Syria*, 9, 278-99, 2 pl., 2 tables, 1928. ISIS

« Notre alphabet nous est venu des Phéniciens par l'intermédiaire des Grecs et des Romains. Ce fut chez les Sémites cananéens que l'alphabet phénicien fut le plus répandu au cours des siècles antérieurs au Christianisme. Il était fixé, achevé peut-on dire, lorsqu'Israël commença à s'installer au pays de Canaan : la découverte de l'inscription d'Akhiram, à Byblos, le prouve nettement. Mais il y a une relation évidente entre les alphabets phénicien, grec et sud-sémitique : quelle est leur source commune? Quel est le peuple qui a donné naissance au premier alphabet? Récemment, on a formulé l'hypothèse que ce furent les Hyksos; n'est-ce point là une gageure? »

Lavagnini, B. L'evoluzione dei metodi nella filologia classica. *Scientia*, 52, 93-101, 1932. ISIS

Meyer-Steineg, Theodor. Arzt und Staat im Altertum. *Judeich Festschrift*, p. 142-59, Weimar, 1929. ISIS

„Wenn man das Arzttum der griechischen Zeit mit dem der römischen vergleicht, so kann keinen Augenblick darüber ein Zweifel aufkommen, welchem der beiden der Vorzug gebührt. Dort in Griechenland wahrhaftige Ärzte und ganze Menschen, jeder eine Individualität für sich; frei von staatlicher Fürsorge und Bevormundung, nur materiell gestützt, wo es nötig war, verrichteten sie ihren Beruf als Priester ihrer Kunst in wirklicher Humanität und sahen in dem Kranken nur den leidenden Menschen, dem zu helfen alleinige Aufgabe erschien. Hier in Rom unter staatlicher Autorität Heilgewerbetreibende, denen der Staat jeden erdenklichen Vorteil und Schutz gewährte, eine Menge von Leuten, einer wie der andere — mit Ausnahme weniger Überragender — Leute, die die ihnen vom Staate gewährleistete günstige Lage vor allem zur Befriedigung ihrer materiellen Bedürfnisse benutzten, Leute, denen oft der Kranke vor allem ein Objekt war, ein Objekt, an dem sich Vorgänge abspielten, die dem Heilkundigen seinen lohnenden Beruf auszuüben gestatteten."

Vogel, Kurt. Neue Quellen und Forschungen zur Geschichte der vorgriechischen Mathematik. *Zeitschr. math. nat. Unterr.*, 62, 289-95, 1931. ISIS

2. — EGYPT

Capart, Jean. Tables astronomiques d'Assiout. *Chronique d'Egypte*, 8, 69-77, 6 fig., 1933. ISIS

After A. POGO, *Isis*, 17, 6-24, 1932.

Carré, Jean-Marie. Voyageurs et écrivains français en Egypte. *Chronique d'Egypte*, 8, 32-43, 1933. ISIS

Apropos of the work of JEAN MARIE CARRÉ.

Chapman, A. Chaston; Plenderleith, H. J. Examination of an ancient Egyptian (TUT-ANKH-AMEN) cosmetic. *Journal of the Chemical Society*, p. 2614-19, 1926. ISIS

Dijksterhuis, E. J. Drie Problemen uit de Aegyptische Wiskunde. *Euclides*, 8, 49-74, 1 pl., 1931-32. ISIS

Goldstein, Miron. Internationale Bibliographie der altaegyptischen Medizin, 1850-1930. Aegyptologischer Verlag MIRON GOLDSTEIN, Berlin-Charlottenburg, 1933 (Rm. 6). ISIS

Inhalt: Allgemeines, medizinische Papyri; Ärztestand, medizinische Gottheiten; Anatomie, Physiologie, Innere Medizin; Chirurgie; Gynäkologie, Geburtshilfe, Kinderheilkunde; Dermatologie, Venerologie, Urologie; Neurologie, Psychiatrie; Ophthalmologie, Otologie; Zahnheilkunde; Tierheilkunde; Pharmacie. Mediocre bibliography with but very few unimportant notes. The price is extravagantly high and this booklet is certainly not worth it. G. S.

Heegard, P. Et gløtt inn i eldegyptisk matematikk. *Norsk matem. Tidsskr.*, Sonder-Abdr. 12 S., 1932. ISIS

Macnaughton, Duncan. A scheme of Egyptian chronology. London, LUZAC, 1932. ISIS

Reviewed by A. H. SAYCE, *Journal of the Royal Asiatic Society*, 145-49, 1933.

Spiegelberg, Wilhelm. La littérature démotique. *Chronique d'Egypte*, 8, 44-68, 1933. ISIS

3. — BABYLONIA AND ASSYRIA

Neugebauer, O. Babylonische " Belagerungsrechnung". *Quellen und*

Studien zur Geschichte der Mathematik, Astronomie und Physik, Abtg. B : Studien, 2, 305-10, 7 fig., 1932. ISIS

Neugebauer, O.; Waschow, H. Bemerkungen über Quadratwurzeln und Quadratwurzel-Approximationen in der babylonischen Mathematik. *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik*, Abtg. B : Studien, 2, 291-97, 1932. ISIS

Thureau-Dangin, François. Les fractions en Sumérien. *Revue d'Assyriol.*, 28, 9-12, 1931. ISIS

Thureau-Dangin, F. Les mesures angulaires " ammatu " et " ubānu". *Revue d'Assyriol.*, 28, 23-25, 1931. ISIS

Thureau-Dangin, F. Mesures de temps et mesures angulaires dans l'astronomie babylonienne. *Rev. d'Assyriol.*, 28, 111-114, 1931. ISIS

Thureau-Dangin, F. Notes sur la terminologie des textes mathématiques. *Rev. d'Assyriol.*, 28, 195-98, 1931. ISIS

Thureau-Dangin, F. La tablette astronomique de Nippur. *Revue d'Assyriol.*, 28, 85-88, 1931. ISIS

Waschow, H. Reihen in der babylonischen Mathematik. *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik*, Abtg. B : Studien, 2, 298-304, 1932. ISIS

Waschow, Heinz. Verbesserungen zu den babylonischen Dreiecksaufgaben S. K. T. 8. *Quellen und Studien zur Geschichte der Mathematik, Astronomie und Physik*, Abtg. B : Studien, 2, 211-14, 1932. ISIS

4. — GREECE

Delatte, Armand. La catoptromancie grecque et ses dérivés. 250 p. 13 pl. Paris, DROZ, 1932. ISIS

Edwards, W. M. The origin of mathematics in Greek culture. *Math. Gaz.*, 15, 449-60, 1931. ISIS

Rehm, A.; Vogel, K. Exakte Wissenschaften. Vierte Auflage. Einleitung in die Altertumswissenschaft ; hrsg. v. ALFRED GERCKE u. EDUARD NORDEN. Bd. II, Heft 5, 78 p. 1933. ISIS

Summary of the whole of Greek science in less than 80 p. with abundant bibliographic information. The notes relative to mathematics, optics, and acustics were written by VOGEL, all others by REHM. G. S.

Zeller, Ed. La filosofia dei Greci nel suo sviluppo storico. Parte I. I. Presocrati. Traduz. sull'ultimo testo originale dell'A (5a) e aggiornamenti oltre la VI e VII edz. redesca, a cura di RODOLFO MONDOLFO. Vol. I. Origini, caratteri e periodi della filosofia greca. XVI+426 p., La Nuova Italia, Firenze, 1932. ISIS

La « Philosophie der Griechen in ihrer geschichtlichen Entwicklung » d'EDUARD ZELLER, restera sans doute encore longtemps un ouvrage indispensable pour les spécialistes. ZELLER en avait revu lui-même la cinquième édition (1891), c'est celle dont R. MONDOLFO entreprend une traduction italienne, de préférence aux éditions postérieurement complétées et remaniées par FRANZ LORTZING, et WILHELM NESTLE, et où le départ ne peut plus se faire de ce qui leur est propre et de ce qui appartient à ZELLER. Le premier volume de MONDOLFO correspond au premier volume de ZELLER; mais le texte de la cinquième édition allemande est complété par des notes courantes du traducteur, et surtout par de longues notes en fin de chapitre qui font connaître au lecteur l'essentiel des travaux les plus récents, tant allemands, anglais ou français, qu'italiens : une note sur le génie hellénique et ses créations spirituelles n'occupe pas moins de 50 pages. L. G.

Zuretti, C. O. Proposte di letture a passi della *Collection des anciens alchimistes grecs publiée par* M. BERTHELOT (seconda serie). *Mélanges Paul Thomas*, 747-51, Bruges, 1930. ISIS

5. — ROME

Collinet, Paul. Beyrouth, centre d'affichage et de dépôt des constitutions impériales. *Syria*, 5, 359-72, 1924. ISIS

« En recherchant dans notre Histoire de l'École de Droit de Beyrouth, dont l'apparition est prochaine, les raisons qui ont déterminé la création de cette École, probablement dès le II^e^ siècle, nous avons été conduit à étudier de près la question de savoir si la fondation de l'École de Droit n'aurait pas eu quelque rapport avec l'existence à Beyrouth d'un dépôt des constitutions impériales. La réponse à cette question, négligée par les rares auteurs qui se sont occupés ou de l'École même ou des constitutions impériales, nécessitait l'établissement préalable du premier terme du rapport, la démonstration, à l'aide d'arguments de vraisemblance ou de preuves tirées des textes, du fait historique que la ville de Beyrouth avait dû être, du II^e^ au VI^e^ siècle, le siège d'un dépôt auquel étaient transmises, pour l'affichage et la conservation, les constitutions intéressant l'Orient ou intéressant au moins certaines de ses provinces ».

Lamer, H. Die Indiktionenzählung (" der Römer Zinszahl "). *Blätter für das bayr. Gymnasialschulwesen*, 67, 340-41, 1931. ISIS

Nilsson, Martin P. Zur Frage von dem Alter des vorcäsarischen Kalenders. *Strena philologica Upsaliensis*, p. 131-36, Upsala, 1922. ISIS

„Es ist wohl möglich, dass die Nachricht von dem zehnmonatigen Jahr auf alter und guter Tradition beruht und den Zustand vor, wenn auch nicht unmittelbar vor der Einführung des dem griechischen entlehnten, vorcäsarichen Kalenders darstellt. Es bestand ein primitives Ackerbaujahr mit nur zehn Mondmonaten. Das Jahr fing mit dem Mondmonat an, in dem die Ackerarbeit im Frühling wieder aufgenommen wurde, und schloss mit der Beendung der Aussaat. Die übrige, nicht mitgerechnete Zeit diente zum Ausgleich zwischen dem Naturjahr und der lunaren Rechnung, indem ihre Unbestimmtheit die Schwierigkeit beide chronologisch zu vereinigen verdeckte".

Olwer, L. Nicolau d'. Dades sobre l'ensenyament a Catalunya a l'època romana. *Miscellania Crexells*, p. 131-39, Barcelona, 1929. ISIS

II. — MIDDLE AGES

6. — MIDDLE AGES (*generalities*)

David, P. Sator arepo. A propos de l'inscription du Valbonnais. Extrait du journal *Le Dauphiné*, 14 p., 1932. ISIS

L'auteur discute surtout l'interprétation chrétienne de Mlle GASTON GIRAUD, mais ne parait pas connaître celle de E. DARMSTAEDTER récemment publiée dans *Isis* (18, 322-29, 1932). Après avoir formulé quelques restrictions, il conclut « Il reste possible que des chrétiens férus d'amulettes aient remarqué que la formule Sator Arepo contient les lettres nécessaires pour écrire deux fois *Pater Noster*. Plus facilement encore, ils auront noté que les trois mots Sator Opera Tenet peuvent signifier dans la langue de la *poésie* chrétienne : *Le Créateur conserve ses ouvrages*. On pourra donc, à titre de pure hypothèse, accepter l'idée que les chrétiens ont volontiers usé de ce palindrome parce qu'ils y ont peut être retrouvé, ou plutôt parce qu'ils y ont mis une expression de leur foi et de leur prière. Mais il reste que par ses origines premières le carré magique Sator Arepo appartient au répertoire cabalistique de la Gaule et de la Grande-Bretagne à l'époque romaine. »

Dombart, Theodor. Eine bedeutsame mittelalterliche Darstellung des Tierkreisbildes der Zwillinge. *Festschrift für Georg Leidinger*, 47-49, 1 pl., München, SCHMIDT, 1930. ISIS

Dufourcq, Albert. Histoire moderne de l'Eglise. T. VI. Le christianisme et l'organisation féodale (1049-1294). 704 p. Paris, PLON, 1932. ISIS

Hulme, E. Wyndham. Currency bars and water-clocks : the verdict of archaeology reviewed. *Antiquity*, 7, 61-72, 3 pl., 3 fig., 1933. ISIS

Discussing the " iron currency bar " theory explained by REGINALD SMITH.
G. S.

Savage, Henry L. Hunting in the Middle Ages. *Speculum*, 8, 30-41, 1933. ISIS

Schnürer, Gustave. L'église et la civilisation au moyen âge. 592 p. Paris, PAYOT, 1933. ISIS

Van De Vyver, A. Les premières traductions latines (X^e^-XI^e^ siècles) de traités arabes sur l'astrolabe. *Extrait du 1er Congrès international de géographie historique*, 2, *Mémoires*, 266-90, 1931. ISIS

Of the three works on the astrolabe attributed to HERMANNUS CONTRACTUS by PEZ and MIGNE, only the first, the *De mensura astrolabii*, was surely the work of HERMANN, although the third, *De mensura horologii*, probably was. The first is not a direct translation from the Arabic, but an attempt to clarify existing notions on the construction of the astrolabe. In so doing, HERMANN considers the second tract, the *De utilitatibus astrolapsus* as the classic work. VAN DE VYVER denies GERBERT's authorship of the *De util* and also refuses to see in it the work translated by LUPITUS, archdeacon of Barcelona, since, he insists, the latter translated an astrological work. (Here V. errs, for *astrologia* was commonly used to mean " astronomy," especially by GERBERT.) He recognizes a tract, *Sententiae astrolabii*, as the direct translation from the Arabic which was the source for the *De utilitatibus*, the same conclusion reached by MILLAS VALLICROSA, whose work was unknown to V. However, V. ascribes its composition to the beginning of the 11th century, since he maintains that MS. Ripoll 225 is of the 11th century, not of the 10th, as more commonly believed. V. announces that he is engaged upon a study devoted to the *corpus* of *compoti*, geometries and astronomies of the early Middle Ages. Incidentally, he calls attention to representations of the so-called Hindu-Arabic numerals in an eleventh century MS. not noted by HILL nor SMITH-KARPINSKI, namely, Leiden, Scaliger 38. H. P. LATTIN.

Vera, Francisco. La cultura española medieval. Datos bio-bibliograficos para su historia. Tomo I. A-G. 362 p. Madrid, Imprenta Gongora, 1933. ISIS

This is the first installment of a biographical dictionary restricted to the Middle Ages and to Spain which will prove very useful. The first volume goes to the end of the letter G. The dictionary itself is preceded by a historical summary, and a chronology extending from 409 (entrance of the Barbarians into Spain on Sept. 28-29; end of the Roman period, beginning of the Middle Ages) to 1492 (fall of Granada). The value of such a work can only be correctly appraised after long usage. My first impression is that the author's documentation does not seem to be up-to-date; in fact, much of it is superannuated; moreover, he seldom if ever quotes articles of scientific periodicals —which contain the newer and living knowledge, but only books, most of them old ones. In many cases his notes might have been notably improved by reference to my *Introduction*. This remark would apply with special

force to the Arabic notes. As the Spanish spelling of Arabic names is very puzzling to foreigners, the value of the work would be increased outside of Spain by the addition of an Arabic index in Arabic script. G. S.

Zinner, E. Merkwürdige mittelalterliche Sonnenuhren. *Die Himmelswelt*, H. 7/8, 8 S., Berlin, 1932. ISIS

Discussion of mediaeval sundials suggested by those recently found in the abbatial church of Steinfeld. G. S.

III. — ORIENTAL SCIENCE AND CIVILIZATION

8. — ASIA

Western Asia

Willis, Bailey. Earthquakes in the Holy Land. *Bulletin of the Seismological Society of America*, 18, 73-103, 21 fig., 1928. ISIS

" The following paper contains a summary of the historical record, so far as it is available in accessible references and a list of 206 dates on which earthquake shocks have occurred since 1606 B.C." " The Palestine earthquake of July 11, 1927, is described from personal observation, and it is pointed out that it exhibited a major and two minor centers of destructive intensity." The title is somewhat misleading, as the data refer not only to the Holy Land but to the whole of Syria. What is worse, the author has used as his earliest authority, SPRENGER's account of AL-SUYŪṬĪ's work on earthquakes (*J. R. A. S.* of Bengal, vol. 12, 741-9, 1843), and has failed to realize that all the dates mentioned by SPRENGER are hegira dates and has dealt with them as if they were Christian dates! Hence this catalogue is all wrong, and the work should be done all over again. The author has prepared a corrective note to appear in *Nature* and other journals.

G. S.

Central Asia

David-Neel, Alexandra; Le Lama **Yongden.** La vie surhumaine de Guésar de Ling, le héros thibétain. Racontée par les bardes de son pays. Préface par SYLVAIN LEVI. LXIV+346 p., illus. Paris, ADYAR, 1931 (20 frs.). ISIS

J'extrais les renseignements suivants de la préface : « Le Guésar est l'Iliade de l'Asie Centrale : le héros qui a donné son nom à l'épopée est aussi connu, aussi populaire chez les Tibétains que chez les Mandchous; autour du Baïkal comme dans le massif de l'Altaï, on raconte ses aventures; on a signalé en Chine des temples dédiés à Guésar et on s'est demandé si on ne devait pas le reconnaître dans Kouan-ti le dieu de la guerre adopté par la dynastie des empereurs Mandchous. » « On a discuté sur le caractère originel de l'ouvrage : bouddhiste, affirment les uns; hostile au bouddhisme affirment d'autres;

d'autres y voient un mythe primitif qui symbolise l'hiver et le printemps. La recension mongole de l'ouvrage est accessible depuis près d'un siècle au lecteur européen; I. J. SCHMIDT en a donné une traduction allemande dès 1839. Des recensions tibétaines, fort inégales d'étendue, ont été signalées; on en possède des manuscrits. Récemment, le missionnaire A. H. FRANKE a imprimé à Calcutta une rédaction qu'il avait recueillie dans le Bas-Ladakh. »

« Les rhapsodes le colportent à travers les hauts plateaux où ils mènent leur vie errante. C'est là que Madame A. DAVID-NEEL a eu l'occasion de les entendre et de noter leurs récits. En attendant qu'elle puisse nous donner le texte original, remercions-la d'avoir révélé au public français, sous une forme pittoresque et attrayante, une épopée qui pour son importance nationale et sa signification de culture vient se ranger auprès de l'Iliade, de l'Énéide, des Nibelungen, du Roland. »

Eastern Asia

(*Including works relative to the whole of Buddhist Asia, or to India, Central and Eastern Asia combined*)

Hummel, Arthur W. Chinese, Japanese, and other East Asiatic books added to the Library of Congress, 1931-32. The Library of Congress, Orientalia added 1931-1932, p. 184-215, 1933. ISIS

" The Library received during the fiscal year 1,179 Chinese works comprising 7,782 pên (volumes) —bringing the total number of Chinese volumes now in the collection to 149,800. Japanese accessions numbered 298 works in 1,250 volumes—or a total of 13,603 in the entire collection. The Korean items were increased by 33, Manchurian 95, Mongolian 26, and the Tibetan by 16. The additions in collective works, or ts'ung shu, numbered 20, making a total of 577."

Additional notes by WALTER T. SWINGLE and SHIO SAKANISHI. G. S.

Przyluski, Jean. Le bouddhisme. 80 p., 60 pl. Paris, RIEDER, 1933. ISIS

9. — INDIA

Coedès, G. A propos de l'origine des chiffres arabes. *Bull. of the School of Oriental Studies*, 6, 323-28, 1 pl., 1931. ISIS

" En résumé, dans les inscriptions sanskrites, l'usage des mots symboliques est attesté pour la première fois au Cambodge en 526 çaka (A.D. 604), au Champa en 609 (A.D. 687) et à Java en 654 (A.D. 732). Dans les inscriptions en vernaculaire, les chiffres avec valeur de position et le zéro apparaissent simultanément en 605 çaka (A.D. 683) à Sumatra et au Cambodge, précédés dans ce dernier pays d'une période pendant laquelle les dates étaient exprimées en langage sanskrit; au Champa, ils ne sont pas attestés avant 735 (A. D. 813).

" Le résultat de cette enquête ne semble pas favorable à la théorie qui assigne une origine indo-chinoise ou indonésienne à l'emploi de mots symboliques sanskrits, car les plus anciens exemples en sont fournis par le Cambodge

où la numération indigène n'était pas décimale; et au Champa, ce système a été précédé par un autre qui faisait usage des noms de nombres sanskrits. Au Cambodge, l'emploi des chiffres est, de même, précédé par celui des noms de nombres sanskrits. De toute façon l'apparition des chiffres avec valeur de position et du zéro dans l'épigraphie indochinoise et indonésienne est nettement liée à l'expression des dates de l'ère çaka, dont on ne saurait contester l'origine indienne. Quelle que soit l'origine ultime de ce système de notation arithmétique, il n'est pas sans intérêt de le trouver attesté en Indochine et dans l'Insulinde dès le VII[e] siècle A.D., c'est-à-dire au moins deux siècles plus tôt que dans l'Inde propre, si l'on adopte les vues pessimistes de M. G. R. KAYE sur les témoignages de l'épigraphie indienne.

Quant à la forme même des chiffres indochinois et indonésiens, elle est pour plusieurs d'entre eux très différente de celle des chiffres indiens; il y a là un nouveau problème dont l'étude contribuerait peut-être à résoudre l'origine exacte des chiffres 'arabes'."

Das, Sukumar Ranjan. The Jaina calendar. *Isis*, 18, 432-37, 1933. ISIS

Follet, R, (S. J.). Quelques sommets de la pensée indienne. 199 p. Paris, BEAUCHESNE, 1932. ISIS

Gāṅguli, Sāradākānta. On the Indian discovery of the irrational at the time of Śulvasūtras. *Scripta mathematica*, 1, 135-41, 1932. ISIS

"The Śulvasūtras not only give an approximate value of $\sqrt{2}$ but also furnish the whole theory on which the general method of finding successive approximations to the square-root of any non-square number is based;" "BÜRK's claim that the Indians discovered the irrational at the time of the Śulvasūtras cannot be lightly rejected."

Gāṅguli, Sāradākānta. The Indian origin of the modern place-value arithmetical notation. Part 3. *American Mathematical Monthly*, 40, 25-31, 1933. ISIS

"The elder ĀRYABHAṬA has given rules for the extraction of the square and cube roots but not for finding the square and cube of a number. BRAHMAGUPTA has given rules for finding the cube as well as the cube root of a number but not for finding the square or the square root. An examination of these rules shows that they were meant to apply to numbers expressed in the modern place-value notations."

Heimann, Betty. Zur indischen Namenkunde. *Ehrengabe für Wilhelm Geiger*, p. 139-55, 1931. ISIS

A very interesting study showing that great difficulties are involved in determining Hindu names or rather in identifying a given name with a definite person. The difficulties with which mediaevalists and Arabists are familiar are comparatively small. G. S.

(India). The Imperial Gazetteer of India. Vol. 26: Atlas. New (revised) edition. VII+66 maps +41 p. Oxford, Clarendon Press, 1931. ISIS

Pizzagalli, A. M. Il concetto di materia e il materialismo indiano. *Scientia*, 52, 167-73, 1932. ISIS

Rapson, Edward James. A volume of Indian studies, presented by his friends and pupils to EDWARD JAMES RAPSON on his seventieth birthday, 12th May, 1931. *Bull. of the School of Oriental Studies*, 6, VI+p. 279-554, 5 pl., 1931. ISIS

Analyzed in present bibliography.

Scheftelowitz, I. Die bedeutungsvolle Zahl 108 im Hinduismus und Buddhismus. *Ehrengabe für Wilhelm Geiger*, p. 85-88, Leipzig, 1931. ISIS

Stein, Aurel. On the Ephedra, the Hūm plant, and the Soma. *Bull. of the School of Oriental Studies*, 6, 501-14, 1931. ISIS

10. — CHINA

Erkes, Eduard. Ueber den heutigen Taoismus und seine Literatur. *Litterae Orientales*, H. 53, 1-5, 1933. ISIS

Favre, B. Les sociétés secrètes en Chine. Origine; rôle historique; situation actuelle. 222 p. Paris, MAISONNEUVE, 1933. ISIS

Feldhaus, F. M. Aus einem alten chinesischen Buch über Landwirtschaft. *Die Ernährung der Pflanze*, Berlin, 5, H. 5, S. 89, 1932. ISIS

1929 wurde in China ein dreibändiges, mit vielen Holzschnitten geschmücktes Buch neugedruckt, das im Jahr 1637 unter dem Titel "T'ien-kung-kai-wu" erschienen war. Dieser Titel bedeutet etwa "Arbeiten des Land- und Bergbaues." Es werden die Ackergeräte, die Maschinen des Landbaues, Bewässerungen, Mühlen, Seidengewinnung, aber auch Maschinen zur Verarbeitung von Seide und Baumwolle, Brunnenbohrer, Salzsiedereien, Bronzeguss, Tauchapparate und Kriegsmaschinen beschrieben und abgebildet. Das Buch ist ein wichtiges Quellenwerk für die Geschichte in China; denn es steht zwischen den beiden grossen chinesischen Lexika von 1609 und 1726 (*Geschichtsblätter für Technik*, Berlin, 1915, Bd. 2, S. 56). Das Lexikon von 1726 ist bereits durch die Jesuiten europäisch beeinflusst. F. M. F.

Glathe, A. Die chinesischen Zahlen. 47 p., 15 pl., 3 fig. Tokyo, Deutsche Gesellschaft f. Natur- u. Völkerkunde Ostasiens, 1932. ISIS

Paukstat, B. Zur Geschichte der chinesischen Medizin. *Sudhoffs Archiv für Geschichte der Medizin*, 26, 72-76, 1933. ISIS

Read, Bernard E. Chinese materia medica. Animal drugs. From the *Pen ts'ao kang mu* by LI SHIH-CHEN, A.D. 1597. Reprinted from *Peking Natural History Bulletin*, 5, part 4, 37-80 and 6, pt. 1, 1-102. Published by the Peking Natural History Bulletin, 1931. ISIS

In 1900, the Rev. GEORGE A. STUART undertook a revision of F. PORTER SMITH's *Chinese materia medica* (Shanghai, 1871) but he lived to complete only the first part, dealing with vegetable drugs (Shanghai, 1911). The present volume is divided into five parts: 1. Domestic animals; 2. Wild animals; 3. Rodentia; 4. Monkeys and supernatural beings; 5. Man as a medicine. Says the author: "With the present widespread interest in organotherapy, vitamine and hormone chemistry the attitude of scientific men toward animal materia medica has greatly changed during the last two decades. Recognizing that these old records are purely empirical in character and that their uses are based largely upon sympathetic and mimetic magic, one may still find a wealth of suggestive thought." English, Latin and Chinese indices. G. S.

Read, Bernard E. Chinese materia medica. Avian drugs. *Peking Natural History Bulletin*, 6, pt. 4, 112 p., 2 pl., Peiping, China, French Bookstore, Hôtel de Pekin, 1932. ISIS

"This extraordinary collection of 77 birds used in ancient Chinese medicine provides material for studies of wide interest. As a record of the natural history of the birds of China the *Pen-Ts'ao Kang-Mu* presents the best summary to be found in old Chinese literature, and supplements the numerous modern publications in this field. Chinese ornithology has had far more attention from scientific workers than any other branch of zoology hence the task of identification of Chinese names is simpler." "As a study in pharmacognosy these avian drugs are today relatively scarce. The few remaining in present day Chinese medicine are used extensively but with the exception of the excreta of four or five animals, chicken's blood, gizzard, eggs, &c there are practically none going through the drug markets. This is not to say that they have fallen entirely into disuse, rather they sustain their place more in the dietetic side of therapeutics in their fresh form, purchased in the local markets, as they extend from Mongolia in the north to the Malay Peninsula in the south. A number retain their place in the dietetics or domestic medicine of Japan and are used throughout Asia to Arabia, and Persia. Studied historically there is a remarkable similarity in the older avian drugs used throughout the entire civilized world."

Swingle, Walter T. Notes on Chinese herbals and other works on materia medica. The Library of Congress, Orientalia added 1931-32, p. 199-207, Washington, 1933. ISIS

The most important event from our point of view is the acquisition of the

original edition (1590) of the *Pên ts'ao kang mu* of LI SHIH-CHÊN. There are only two other copies known, both in Japan. Interesting notes on maize in China, ma huang (Ephedra sp.). G. S.

Torii, Ryguso. Les Dolmens du Chantung (Chine). *Revue anthropol.*, 4, 361-66, 5 fig., 1930. ISIS

12. — ISRAEL

Krauss, Samuel. Geschichte der jüdischen Ärzte vom frühesten Mittelalter bis zur Gleichberechtigung. Preisgekrönte Arbeit, durchgesehen von ISIDOR FISCHER. XVI+180 p. (*Veröffentlichungen der A. S. Bettelheim-Stiftung in Wien*, Bd. 4). Vienna, PERLES, 1930 (M. 7.50). ISIS

Inhalt : 1. Die Juden in der Wissenschaft des Mittelalters im allgemeinen, in der Medizin im besonderen. Im Orient und Okzident; 2. Die jüdischen Ärzte in Deutschland bis zum Ausgange des Mittelalters; 3. Der Aberglaube als Hindernis der Medizinwissenschaft; 4. Die Judenärzte in volkstümlicher Vorstellung; 5. Kanonische, landesfürstliche und Hochschul-Gesetze; 6. Anfeindung und Verteidigung; 7. Standesverhältnisse der jüdischen Ärzte; 8. Die Förderung der Medizin durch die Juden; Nachträge und Berichtigungen; Register.

14. — ISLAM

(Arabic, transliteration of). Notes by ALDO MIELI, H. P. J. RENAUD, and FRANZ TAESCHNER. *Archeion*, 14, 436-44, 1932. ISIS

Desson, Henri. Ce qu'il faut savoir de l'Islam. 160 p. Paris, BOIVIN, 1932. ISIS

Faddegon, Johan Melchior. L'état actuel des études concernant les sciences exactes en Orient durant le moyen âge. *Archeion*, 14, 372-91, 1932. ISIS

Farmer, Henry George. An old Moorish lute tutor. Being four Arabic texts from unique manuscripts in the Biblioteca Nacional, Madrid (no. 334) and the Staatsbibliothek, Berlin (Lbg. 516). Edited with translations, commentary, and an appendix. X+53 p., frontispiece, illus. (*Collection of Oriental writers on music.* — I. Edited by HENRY GEORGE FARMER.) Glasgow, Civic Press, 1933 (Price, 5/6). ISIS

Edition de luxe (225 copies printed) of articles originally published in the *J. R. A. S.* (1931-32) and as such registered in *Isis*. The text has been remodelled. " Quite apart from solving the problem of the identity of the twenty-four naubāt or ṭubū' of the Moors of Spain, the question of the

Moorish influence on European music assumes an interesting aspect through the publication of these documents, especially in relation to tablature and notation, as well as *accordatura*." G. S.

Ferrand, Gabriel. Geographie et cartographie musulmanes. *Archeion*, 14, 445-47, 1932. ISIS

Frankl, Theodor. Die Anatomie der Araber. I. Die Nomenklatur des Verdauungstraktes. Eine philologische und kulturhistorische Studie. 148 p. Prague, CALVE, 1930. ISIS

" Im Folgenden werden die arabischen Ausdrücke für einzelne Teile des Verdauungsapparates zusammengestellt und gedeutet. Wir werden sehen, wie gross die Zahl solcher Ausdrücke sein kann, die einen und denselben Gegenstand bezeichnen. Trotzdem ich mich bemüht habe, durch Untersuchung aller wichtigen Quellen womöglich sämtliche Termini der anatomischen Nomenklatur des Verdauungsapparates ausfindig zu machen — lag aber beim Verfassen dieses Buches nicht das Bestreben zugrunde, die Schätze der an Synonymen so reichen arab. Sprache zu sammeln, sondern bezweckte ich vielmehr, durch Untersuchung des Bedeutungswandels und der Etymologie der einzelnen Ausdrücke den Gedankengang des Arabers und die psychologischen Zusammenhänge seiner Wortbildung zu beleuchten."

Issa Bey, Ahmed. Dictionnaire des noms des plantes en Latin, Français, Anglais et Arabe. Première édition. XVI+223+64 p. (Ministère de l'instruction publique d'Egypte). Le Caire, Imprimerie Nationale, 1930. ISIS

« J'ai transcrit les noms des plantes tels que je les ai découverts, en respectant l'orthographe des termes purement arabes aussi bien que celle des mots arabisés ou métis. De plus, je me suis efforcé de ne commettre aucune omission, répondant ainsi aux buts suivants qui sont actuellement poursuivis par tous les écrivains et les savants du siècle : (1) Que le dictionnaire contienne tous les noms des plantes cités dans les ouvrages arabes, quelle que soit l'origine de ces noms. (2) Qu'il ne serve pas seulement de référence pour connaître les noms des plantes, mais qu'il puisse être également utile à identifier l'origine des mots étrangers cités dans les ouvrages arabes. Il sera donc en quelque sorte, un supplément aux autres dictionnaires arabes, supplément auquel on se reportera pour reconnaître les origines des mots. » L'ordre principal est celui des mots latins, mais la valeur pratique de l'ouvrage est augmentée par la présence d'index français, anglais, et arabe. Ce dernier sera surtout précieux; il remplit 64 p. de 3 colonnes chacune. Pour d'autres ouvrages du même auteur, voir *Isis*, 8, 597; 14, 535. G. S.

Massignon, Louis. L'arithmologie dans la pensée islamique primitive. *Archeion*, 14, 370-71, 1932. ISIS

Mittwoch, Eugen. Ein corpus medicorum arabicorum. *Archeion*, 14, 453-57, 1932. ISIS

Pretzl, Otto. Die frühislamische Atomenlehre. Ein Beitrag zur Frage über die Beziehungen der frühislamischen Theologie zur griechischen Philosophie. *Der Islam*, 19, 117-30, 1931. ISIS

Largely based on AL-ASH'ARĪ's Maqālāt edited by H. RITTER, 1929-30. G. S.

Renaud, H. P. J. Sur l'état des études relatives à la médecine arabe. *Archeion*, 14, 448-52, 1932. ISIS

Ritter, H. " La parure des cavaliers " und die Literatur über die ritterlichen Künste. *Der Islam*, 18, 116-54, 1929. ISIS

Criticism of LOUIS MERCIER's edition and translation of IBN HUDHAIL (1922-24; *Isis*, 8, 346-49), followed by an elaborate catalogue of MSS. works on hippology, riding (furūsīya), chivalry (futuwwa) and connected subjects in the Istanbul libraries. G. S.

Ruska, Julius. Arabische Alchemie. *Archeion*, 14, 425-35, 1932. ISIS

1. MARCELLIN BERTHELOT; 2. Wiederbeginn der arabischen Studien; 3. Die Lösung des DJĀBIR-Problems; 4. Der Schriftenkreis um AL RĀZĪ; 5. KHĀLID IBN YAZĪD; 6. Lehrschriften in Gesprächsform; 7. Die Alchemie des AL TUGHRĀ'Ī; 8. Zukunftsaufgaben.

Ruska, Julius. Arabische Giftbücher. *Fortschritte der Medizin*, 50, 12 p., 1932. ISIS

Analysis and discussion of three Arabic books on poisons. The first is the one ascribed to the Hindu SHĀNĀQ, first studied by AUGUST MÜLLER (*Z. d. m. G.*, 34, 1880), and largely of Hindu origin; the second is the one ascribed to JĀBIR IBN ḤAIYĀN; the third is the one included in IBN SĪNĀ's Qânûn. Important. G. S.

Schacht, Joseph. Einige Kairiner Handschriften über furūsīja und futūwa. *Der Islam*, 19, 49-52, 1931. ISIS

Stern, Philippe. Le congrès de musique arabe du Caire et l'histoire de la musique arabe. *Archeion*, 14, 420-24, 1932. ISIS

Winkler, H. A. Siegel und Charaktere in der muhammedanischen Zauberei. x+187 p., 3 pl. (*Studien zur Geschichte und Kultur des islamischen Orients*. Zwanglose Beihefte zu der Zeitschrift "*Der Islam*"; hrsg. v. C. H. BECKER, H. 7). Berlin, DE GRUYTER, 1930. ISIS

„Beim Durchblättern von Zauberbüchern — gleich, ob europäischer oder orientalischer, antiker, mittelalterlicher oder moderner, ob chinesischer oder indischer — fallen die sonderbaren Zeichnungen, geometrischen Kompositionen und buchstabenähnlichen Charaktere ins Auge, die hier oft eingestreut

sind. Der Blick des wissenschaftlichen Betrachters wird wie der des Zauberers von diesen Zeichen festgehalten. Vielfach werden in Arbeiten über Zauberei, bei Textausgaben und Übersetzungen gerade diese Zeichen nicht mitgeteilt, oft wohl aus Rücksicht auf die typographischen Schwierigkeiten. Aber auch das Interesse für diese sinnlosen Zeichen ist, wie entsprechend für sinnlose Zauberworte, meist gering. Sie spielen aber in der Zauberei überhaupt und in der muhammedanischen besonders eine wichtige Rolle. Sie haben sich von Generation zu Generation vererbt und bewahren altertümliche Denkmäler, deren Untersuchung sich lohnt. Um die Stellung der Siegel und Charaktere in der muhammedanischen Zauberei zu erkennen, ist es nötig, auch die Umgebung, in der sie in den Zauberbüchern erscheinen, überhaupt die Ideenwelt des Zauberers zu beleuchten. So finden sich im folgenden auch Feststellungen, die nichts mit den Charakteren unmittelbar zu tun haben, die aber doch vielleicht zum Verständnis der Menschen, die mit jenen Zeichen zauberten, helfen". Inhalt: Einleitung; 1. Die Schreckhaftigkeit des Zauberers; 2. Die „Potenzen" des Zauberers; 3. Der Sinn des Zauberers für Totalität; 4. Die Anhäufung ähnlicher Eindrücke in der Zauberpraxis ; 5. Das Faszinierende des Zauberspruches ; 6. Das Faszinierende der Zauberzeichen; 7. Die Neigung des primitiveren Menschen, in befremdende Erscheinungen erwas Bekanntes hineinzusehen oder hineinzuhören. Die sieben Siegel (p. 55-149). Die Brillenbuchstaben (p.150-67).

Würschmidt, Joseph. Die Schriften GEDOSIS über die Höhenparallelen und über die Sinustafel (zum Gebrauch des Quadranten im Islam). Sonderabdruck aus den *Sitzungsberichten der physikalisch-medizinischen Sozietät zu Erlangen*, 60, 127-54, 6 fig., 1928. ISIS

" In zwei früher erschienenen Arbeiten habe ich einen von mir in Konstantinopel aufgefundenen Quadranten beschrieben und gezeigt, wie mittels dieses Instrumentes eine Reihe von Aufgaben der mathematischen Geographie bezw. der sphärischen Trigonometrie auf mechanischem Wege, ohne Benutzung von Tabellen, gelöst werden kann, und wie dieser Quadrant vor allem zur Bestimmung der im religiösen Leben des Islam so wichtigen Gebetszeiten benutzt wird. Am Schlusse der zweiten Arbeit wies ich darauf hin, dass die letztere Aufgabe auch heute noch von den muhammedanischen Geistlichen mittels des Quadranten gelöst wird; diese werden in den Theologenschulen mit der Handhabung des Instruments vertraut gemacht, und diesem Unterricht wird eine Schrift eines gewissen GEDOSI zugrunde gelegt."

This study is based upon a Turkish text lithographed in Istanbul in 1909, the author being SULEIMAN MURAD BEN 'UMAR BEN AḤMED BEN SA'ADI AL-GEDOSI, who composed it in 1851-52. The text is completely analyzed and extracts are translated. G. S.

PART III

SYSTEMATIC CLASSIFICATION

I. — SCIENCE IN GENERAL

16. — HISTORY OF SCIENCE

Dannemann, Friedrich. Vom Werden der naturwissenschaftlichen Probleme. Grundriss einer Geschichte der Naturwissenschaften. XII+376 p., 82 fig. Leipzig, ENGELMANN, 1928 (Rm. 19). ISIS

This is a useful condensation of the author's four-volume work, *Die Naturwissenschaften in ihrer Entwicklung und in ihrem Zusammenhang* (1920-1923) and constitutes the second part of his *Aus der Werkstatt grosser Forscher* (1922). It presents not only an account of the lives and accomplishments of the great masters of the natural sciences and technologies, but for each discipline and for each successive period it aims to weave the component elements into a whole by an analytic and synthetic correlation of its component parts. The physical sciences are brought up to X-ray and radium, but biology stops with the cell theory and natural selection. There is a classified selected bibliography of all fields and a comparative chronological table of scientific discoveries and political and cultural development. C. A. K.

Enseignement scientifique. Sixième année nº 54. Janvier 1933. LÉON EYROLLES, 3 rue Thénard, Paris V. Prix de l'abonnement annuel : France : 25 fr. ; Etranger : 30 fr. ISIS

« Enquête sur l'histoire des sciences dans l'enseignement. Ce numéro est consacré pour la plus grande partie à notre enquête sur l'histoire des sciences qui est close dès maintenant; il nous permettra de faire un exposé récapitulatif dans le prochain numéro. » Réponses de HENRY LE CHATELIER, E. BAUER, M. ZORETTI, PIERRE BRUNET (notes bibliographiques), H. METZGER, A. TURPAIN (notes sur FARADAY), PIERRE ABRAHAM.

Gukovski, M. A. Italian encyclopaedias of the XIIIth to XVIth centuries. *Trudy instituta knigi*, 2, 43-64 (In Russian, with abstract in Italian). ISIS

Apropos of the works of BRUNETTO LATINI, BARTOLOMEO ANGLICO, UGUCCIO PISANO, GIOVANNI DA GENOVA, DOMENICO DI BANDINO, GIOVANNI GORO DA SAN GIMINIANO, GASPARINO DA BARZIZZA, GIOVANNI DA FONTANA, GIOVANNI TORTELLO, RAFFAELE MAFFEI, and GIORGIO VALLA. A survey of the scientific material preserved in these works and of their structure. Based on the rather limited number of books accessible to the author. This is " the first attempt to approach the scientific material of the XIII-XV centuries with methodological premises which differ rather sharply from the methodological premises of existing synthetic bourgeois studies devoted to the history of science in general and to the given period in particular." A. P.

(History of science). The sciences as an integral part of general historical study. *Archeion*, 14, 271-88, 1932. ISIS

Papers and notes presented June 30, 1931 at the Second International Congress of the history of science of London, first session. Opening address by GINO LORIA, Genoa; opening paper by G. N. CLARK, Oxford; papers, notes and remarks by Sir W. DAMPIER-WHETHAM, Cambridge; A. V. HILL, London; A. M. MASHARRAFA, Cairo; E. COLMAN, Moscow; M. RUBINSTEIN, Moscow; N. BUKHARIN, Moscow; B. ZAVADOVSKI, Moscow; A. YOFFE, Leningrad; TH. GREENWOOD, London.

Locke, L. Leland. Synchronism and anachronism. *Scripta mathematica*, 1, 147-52, 1932. ISIS

Apropos of synchronic and anachronic inventions. G. S.

Mieli, Aldo. Rapport sur l'enseignement de l'histoire des sciences, présenté à la première conférence internationale pour l'enseignement de l'histoire (La Haye, 30 juin—2 juillet 1932) au nom du comité international d'histoire des sciences. *Archeion*, 14, 261-66, 1932. ISIS

Milhaud, Gérard. Conclusions à l'enquête sur l'histoire des sciences dans l'enseignement. *L'enseignement scientifique*, n° 55, 148-53, 1933. ISIS

Rainov, T. History of science in the works of GEORGE SARTON. (In Russian). *Socialist reconstruction and science*, no. 9/10, p. 138-48, 1932. ISIS

Detailed review of vols. 1 and 2 of the *Introduction* with references to *The History of Science and the New Humanism*, and to *Isis*. A. P.

Sarton, George. Introduction to the History of Science, vol. 2 : From RABBI BEN EZRA to ROGER BACON. In two parts. XXXV+1251 p. Baltimore, WILLIAMS & WILKINS, 1931. ISIS

Reviewed by WILLIAM BEEBE, *New York Herald*, Feb. 12, 1932; by PIERCE BUTLER, *The Library Quarterly*, 3, 123-24, 1933; by ARTURO CASTIGLIONI, *Rivista di storia delle scienze med. e natur.*, 23, 216-17, 1932; detailed review by T. RAINOV, *Socialist reconstruction and science*, no. 9/10, p. 138-48, 1932 (in Russian).

Sarton, George ; Pogo, Alexander. Thirty-fourth Critical Bibliography of the history and philosophy of science and of the history of civilization (to March 1932). *Isis*, 18, 440-540, 1933. ISIS

This Critical Bibliography contains about 670 items contributed by 14 scholars.

17. — ORGANIZATION OF SCIENCE

(Internal organization is meant, see Isis, 1, 195. *For external organization, national or international, see section* 55)

Science at the cross roads. Papers presented to the International Congress of the History of Science and Technology held in London from June 29th to July 3rd, 1931 by the delegates of the U.S.S.R. Kniga (England). London, Bush House, Aldwych, 1931. ISIS

" This book is a collection of the papers presented to the Second International Congress of the History of Science and Technology by the Delegation of Soviet Scientists. In Soviet Russia absolutely new prospects are opening before science. The planned economy of Socialism, the enormous extent of the constructive activity—in town and village, in the chief centers and in the remotest parts—demand that science should advance at an exceptional pace. The whole world is divided into two economic systems, two systems of social relationship, two types of culture. In the capitalist world the profound economic decline is reflected in the paralysing crisis of scientific thought and philosophy generally. In the Socialist section of the world we observe an entirely new phenomenon : a new conjunction of theory and practice, the collective organisation of scientific research planned on the scale of an enormous country, the ever-increasing penetration of a single method—the method of Dialectical Materialism—into all scientific disciplines." One wonders what is meant by the sentence " the paralysing crisis of scientific thought and philosophy generally," for we are witnessing to-day almost everywhere an abundance of scientific efforts of the first order. There is no depression in science, nor any danger of overproduction. On the other hand, how many scientific achievements can be put to the credit of Soviet Russia? There are great scientists in Russia, e.g., Ivan Petrovich Pavloff honored by the whole world; yet far less than in a single little country like the Netherlands. A few individual papers of this volume which may be of special interest to our readers, are classified in this bibliography under their respective headings. Others are simply elaborations of the quotation given above, and of the contrast between " bourgeois " science and soviet science. G. S.

II. — FORMAL SCIENCES (knowledge of forms)

19. — LOGIC AND THEORY OF KNOWLEDGE

Zavirski, Sigismond. Les logiques nouvelles et le champ de leur application. *R. de métaphysique et de morale*, 39, 503-19, 1932. ISIS

I. La logique de Jan Lukasiewicz (Philosophische Bemerkungen zu mehrwertigen Systemen des Aussagenkalküls, Varsovie, 1930; J. Lukasiewicz et A. Tarski : Untersuchungen über das Aussagenkalkül, Varsovie, 1930. II. La logique de L. E. J. Brouwer : Intuitionistische Zerlegung mathe-

matischer Grundbegriffe, Leipzig, 1925; et de A. HEYTING : Die formalen Regeln der intuitionistischen Logik, Berlin, 1930. III. Application de la logique à plusieurs valeurs dans les sciences physiques. L. G.

20. — MATHEMATICS

Archibald, R. C. Bibliographia de mathematicis - I. *Scripta mathematica*, 1, 173-81, 1932. ISIS

Bibliographical information concerning a great many mathematicians listed in alphabetical order. G. S.

Archibald, R. C. Bibliographies of projective differential geometry. *Scripta mathematica*, 1, 171, 1932. ISIS

Biržiška, Victorias. Ueber die Entwicklung der Wahrscheinlichkeitsrechnung. *Kosmos*, 12, 81-104, Kaunas, 1931. (Litauisch). ISIS

Bortolotti, Ettore. La propagazione della scienza attraverso i secoli. *Scientia*, 52, 273-86, 1932. ISIS

Partant des fractions unitaires des anciens Egyptiens, BORTOLOTTI passe aux « fractiones in gradibus » de LEONARDO PISANO, aux fractions continues ascendantes, aux séries de puissances, aux séries de factorielles, à l'équation de l'optique, et à celle des moyennes harmoniques. L. G.

Colman, E. The present crisis in the mathematical sciences and general outlines for their reconstruction. 15 p. Science at the Cross Roads, London, Kniga, 1931. ISIS

" To solve all these theoretical and practical problems, to overcome the crisis in present-day mathematics, to reconstruct it along socialist lines, patient and persistent work is necessary, the collective work of all Soviet mathematicians and of those scientists in capitalist countries who wish to go with us. Proceeding from the Leninist theory of the unity of theory and practice, we in the Soviet Union shall reconstruct the mathematical sciences. Acknowledging the Leninist principle that the sciences are not impartial, we shall place mathematics at the service of socialist construction and in this way save it from the decay that is inescapable under capitalism."

Dantzig, Tobias. Number, the language of science. A critical survey written for the cultured non-mathematician. Second edition, revised. VIII+262 p., 12 illus. New York, MACMILLAN, 1933. ISIS

The first edition (1930) was fully reviewed in *Isis*, 16, 455-59. According to the preface to the new edition : " The book received a very warm welcome, both here and abroad ; soon after its publication here, a special British edition and a French translation followed; German and Russian translations are also under way."... " The revision has been confined to the correction of errors, typographical and other, to the clarification of some obscure passages, and the recasting of several paragraphs deemed infelicitous. There has also

been added a page of bibliographical notes suggesting further reading to those interested." G. S.

Dijksterhuis, E. J. Historische Revue. *Euclides*, 7, 185-95, 1930/1931. ISIS

Etwa 40 Besprechungen über neuere Arbeiten aus dem Gebiete der Geschichte der Mathematik und Naturwissenschaften. K. V.

Errera, Alfred ; Godeaux, Lucien. Les mathématiques en Belgique de 1830 à 1930. *Mathesis*, 46, suppl. 17 p., 1932. ISIS

Fettweis, Ewald. Über das Verhältnis des mathematischen Denkens zum mystischen Denken auf niederen Kulturstufen. *Archeion*, 14, 207-20, 1932. ISIS

De l'utilité, pour parvenir à une compréhension vraie des conditions (Zustände) mathématiques dans les civilisations anciennes, de l'étude des connaissances mathématiques des peuples actuels, dits primitifs, et des relations chez ces peuplades analphabétiques, entre mathématique et mystique. L. G.

Johnson, R. A. ; Archibald, R. C. Postage-stamp or coin portraits of mathematicians. *Scripta mathematica*, 1, 183-84, 1932. ISIS

Karpinski, Louis C. Linear and quadratic, straight and square. *School Science and Mathematics*, 34-39, 1933. ISIS

" No mathematician wishes to exalt the mathematics as more worthy of study than plant life or animal life or physical and chemical phenomena, nor does the mathematician try to cast any doubt upon the desirability of the study of art, including literature and music and the drama. But emphatically the mathematician wishes it made clear that ideas are fundamental, that the line and the circle are with us to be understood, and that no one can pretend to any serious comprehension of the universe in which we live without understanding some algebra and geometry—the linear and the quadratic, the straight and the square."

Keyser, Cassius Jackson. The bearings of mathematics. *Scripta mathematica*, 1, 93-110, 1932. ISIS

Kubota, T. On the history of problems of elementary geometry (in Japanese). *Journal of the Mathematical Association of Japan for Secondary Education*, 14, 151-60, 1932. R. C. A. ISIS

Loria, Gino. Di alcuni aspetti sotti qui presentansi li ricerche storiche nel campo matematico. *Archeion*, 14, 198-206, 1932. ISIS

Examen de quelques aspects des recherches historiques : les mots historiques (on peut accepter le mot d'EUCLIDE à son souverain « en géométrie, il n'existe pas de route royale »; on ne peut admettre celui de GALILÉE « et pourtant elle

se meut »); on ne peut non plus admettre l'anecdote de la chute de la pomme qui serait à la base de la découverte par NEWTON de la loi de la gravitation; les problèmes qui attendent toujours leur solution (p. ex. origine de notre système de numération, invention du calcul infinitésimal, nationalité de COPERNIC); les difficultés que peut présenter l'étude des sources.

L. G.

Miller, G. A. Historical note on negative numbers. *American Mathematical Monthly*, 40, 4-5, 1933. ISIS

Miller, G. A. Meaning of the word billion. *School and Society*, 33, 591, 1931. ISIS

Mordukhai-Boltovskoy, D. The concept of infinity. Historical and critical notes. *Scripta mathematica*, 1, 132-34, 1932. ISIS

Noury, Paul. Technique de la manière d'exprimer les nombres avec les doigts en usage chez les Romains, d'après un dictionnaire persan du XVII[e] siècle. *Bulletin de l'Association Guillaume Budé*, n° 36, 40-45, 1932. ISIS

Peano, Giuseppe (1858.08.27-1932.04.20). Obituary by MARIO GLIOZZI. *Archeion*, 14, 254-55, 1932. ISIS

Thureau-Dangin, F. Esquisse d'une histoire du système sexagésimal. 81 p. Paris, GEUTHNER, 1933. ISIS

Vera, Francisco. Historia de la matematica en España. Vol. 2: Los precursores del Renacimiento. Sigios XIII, XIV y XV. 512 p. Madrid, SUAREZ, 1931. ISIS

Vetter, Quido. Notation of decimal fractions in Bohemia. *American Mathematical Monthly*, 39, 511-14, 1932. ISIS

" To summarize the matter we see that at the end of the 18th century and at the beginning of the 19th century with us, as generally on the Continent, the decimals were separated from their integers by a comma below. In the years 1830-1840, the raised decimal point was introduced from Austria; and this symbol, under the influence of the centralized schools and the new currency, continued until the second half of the century."

III. — PHYSICAL SCIENCES (knowledge of inorganic nature)

22. — MECHANICS

(Including celestial, and atomical mechanics)

Boll, Marcel. L'idée générale de la mécanique ondulatoire et de ses premières applications. Atome d'hydrogène; phénomènes

chimiques; conduction électrique. 74 p. Paris, HERMANN, 1932. ISIS

I La liaison entre l'optique et la mécanique; II. Les relations d'incertitude; III. Les niveaux d'énergie; IV. Valence et affinité chimique; V. La conduction électrique des métaux.

Broglie, Louis de. Théorie de la quantification dans la nouvelle mécanique. XXVIII+250 p., Paris, HERMANN et Cie, 1932. (70 fr.) ISIS

« Il m'a paru intéressant de poursuivre l'exposé que j'avais commencé dans mon « Introduction à l'étude de la Mécanique ondulatoire » (*Isis*, 15, 258) en approfondissant l'idée de quantification dans la nouvelle Mécanique et en développant la théorie abstraite et générale qui a été élaborée dans ces dernières années par d'éminents théoriciens de la Physique tels que MM. HEISENBERG, JORDAN et DIRAC et qu'on nomme souvent la théorie des transformations ». « Pour faire cet exposé, j'ai écarté la pure méthode des matrices brillamment développée par MM. HEISENBERG et BORN et la méthode de l'algèbre des nombres non commutatifs si attrayante malgré son abstraction par sa rigueur et sa généralité dont nous sommes redevables à M. DIRAC. Je me suis placé systématiquement au point de vue de la Mécanique ondulatoire qui me paraît le plus facilement accessible et j'ai cherché à rattacher la théorie abstraite et générale dont je viens de parler à l'exposé que je fais d'habitude des principes de cette nouvelle Mécanique. Mon mode d'exposition se trouve ainsi se rapprocher de celui qu'a employé M. WEYL au début de son célèbre ouvrage : « Gruppentheorie und Quantenmechanik ».

23. — ASTRONOMY

Astronomischer Jahresbericht. Herausgegeben v. Astron. Rechen-institut zu Berlin-Dahlem. Bd. 32 : Die Literatur des Jahres 1930. XXVII+295 p. Berlin, DE GRUYTER, 1931. ISIS

Bigourdan, Guillaume. Le Bureau des longitudes. (V^e^ partie). *Annuaire du Bureau des longitudes* pour l'an 1932, Notice A, 117 p., Paris, GAUTHIER-VILLARS, 1932. ISIS

Bigourdan, Guillaume (1851-1932). Obituary by PIERRE BRUNET, in *Archeion*, 14, 256, 1932. ISIS

Dombart, Th. Die Darstellung oder Andeutung der Himmelswölbung durch ein halbes Sechs-Eck. *Ehrengabe für* WILHELM GEIGER, 1931, p. 319-23, 5 fig. ISIS

Fayet, G. Les petites planètes. *Annuaire du Bureau des longitudes* pour l'an 1932, notice B, 146 p., 16 fig., tables, Paris, GAUTHIER-VILLARS, 1932. ISIS

Contents : Première partie — Exposé historique. 1. Époque antérieure aux découvertes; 2. Découverte de Cérès; 3. Découvertes de Pallas, Junon et Vesta; 4. Seconde phase des découvertes jusqu'en 1891; 5. La recherche visuelle des petites planètes et leur observation; 6. Les découvertes photographiques des astéroïdes; 7. Recherches théoriques. Travaux de calcul; 8. Éclat. Variation d'éclat; 9. Spectre; 10. Grandeur moyenne. Diamètre. Masse globale; 11. Désignation provisoire. Identification éventuelle des objets insuffisamment observés; 12. Astéroïdes offrant un intérêt particulier. Deuxième partie — Étude statistique.

Gifford, A. C. The origin of the solar system. I. From the Chaldeans to CHAMBERLIN and MOULTON ; II. From JEANS to the present day. *Scientia*, 52, 141-56, 203-22, 1932. ISIS

Goldschmidt, Victor. Der Planet Pluto und die Harmonie der Sphären. Heidelberg, WINTER, 1932. ISIS

It is interesting to witness the periodical revival of Pythagorean fancies. GOLDSCHMIDT's book is a good example. See review of it and of two other elucubrations by the same author, by J. RUSKA, *DLZ*, 4, 185-86, 1933. G. S.

Häfker, Hermann. Etwas von den Märchen und Sagen der Sternbilder. *Das Weltall*, 31, 28-29, 1931. ISIS

Messerschmidt, Franz. Himmelsbuch und Sternenschrift. *Röm. Quartalsschrift f. christl. Altertumskunde*, 39, 63-69, 1931. ISIS

Rachmati, G. R. Zur Frage des 12-jährigen Tierzyklus bei den Turkvölkern. *Ungarisches Jahrb.*, 11, 298-99, 1931. ISIS

Zinner, E. Die astrologische Treffsicherheit. *Gesundheitslehrer*, H. 11, Ausgabe A, 1932. ISIS

General discussion suggested by the astrological revival which we are witnessing to-day. Astrologers flourish in hard times ! Special attention is paid to the two following publications : JOHANNES CLASSEN, Naturwissenschaftliche Astrologie, Düsseldorf, 1931; H. Frh. v. KLÖCKLER, Astrologie als Erfahrungswissenschaft, Leipzig, 1927. G. S.

Zinner, E. Besassen die alten Germanen astronomische Kenntnisse ? *Die Umschau*, 35, 649-52, 1931. ISIS

Zinner, Ernst. Untersuchungen zur Geschichte der Sternkunde. 26. *Bericht Naturforsch. Ges. Bamberg*, 1-62, 2 fig., 1932. ISIS

1. Die Untersuchung der frühgermanischen Sternkunde (Hauptquelle : Sammlung Thule, F. NIEDNER, Jena 1920/1928) stellt fest, dass die heidnischen Germanen zwar einfache Beobachtungen machten (Z. B. Sonnenlauf, Mondalter), dass aber von einer Wissenschaft keine Rede sein kann. Es

gibt keine Ueberlieferung über Beobachtungsreihen zur Erforschung des Himmels, über Kalender, über Sterndeutung. Erst nach Berührung mit dem Christentum wurde ihre zeitliche und räumliche Orientierung vervollkommnet. 2. Im Gegensatz zu der für Aegypter, Griechen, Chinesen und Christen gültigen Orientierungstheorie sind "die Versuche, aus den Richtungen von Steinkreisen, Steinreihen... Schlüsse auf vorgeschichtliches Wissen zu ziehen" für die Germanen unhaltbar. 3. Behandelt die Zeitorientierung vor der Erfindung der Räderuhr. 4. Die alten Masse am Bamberger Dom. 5. Auf Grund der verschiedenen Genauigkeit astronomischer Beobachtungen werden Kulturkurven aufgestellt, wobei sich ZINNER gegen die vier wissenschaftlichen Entwicklungsstufen SARTONS (The hist. of science and the New Humanism, 1931, p. 115 f.) wendet, besonders deshalb, weil die babylonische Sternkunde dabei zu schlecht wegkommt. Solche auf Grund einer Ein elwissenschaft aufgestellte Kurven geben freilich nur ein einseitiges Bild. 6. Der Nachtrag: Alte Sonnenuhren an Bamberger Gebäuden beschliesst die treffliche und gut belegte Arbeit. K. V.

Zinner, E. Warum Sternkunde der Germanen? *Die Himmelswelt*, H. 10, 4 p., 1931. ISIS

24. — PHYSICS

Joergensen, Joergen. Remarques sur les principales implications métaphysiques des théories et des idées récentes de la physique. *R. de métaphysique et de morale*, 39, 323-51, 1932. ISIS

Lüdemann, Karl. Zur Geschichte der Dosenlibelle. Beiträge z. Gesch. d. geodät. u. markscheiderischen Messungswesens u. d. vermessungstechnischen Instrumentenkunde, Nr. 12, *Zeitschr. f. Instrumentenkunde*, 51, 136-44, 1931. ISIS

Rohr, M. v. Der Astigmatismus in sprachlicher und sachlicher Hinsicht. *Die Naturwissenschaften*, 20, 847-50, 1932. ISIS

Rohr, M. v. Die Erkenntnis von dem wahren Wesen des Lichtbildes und ihr Einfluss auf das Verständnis fur die optischen Geräte im allgemeinen. *Die Naturwissenschaften*, 20, 496-501, 514-20, 1932. ISIS

Rohr, M. v. Über Geschichtstabellen für die technische Optik. *Die Naturwissenschaften*, 20, 937-40, 1932. ISIS

25. — CHEMISTRY, PHYSICO-CHEMISTRY, INDUSTRIAL CHEMISTRY

Färber, Ed. ED. O. VON LIPPMANN zum fünfundsiebzigsten Geburtstag. *Die Naturwissenschaften*, 20, 25-28, 1932. ISIS

Goldschmidt, G. Manuscrits d'Allemagne, d'Autriche, de Danemark, de Hollande et de Suisse. XXVI+446 p. (*Catalogue des manuscrits alchimiques grecs*, 4). Bruxelles, Union académique internationale, Palais des Académies, 1932. ISIS

This Catalogue is so well known to our readers—every volume thus far published having been reviewed in *Isis*—that it will suffice to announce the appearance of this new installment. The "Vorwort" (20 p.) contains interesting information on the history of the MS. collections analyzed. There are two important appendices.

I. Die Diatribe des TH. REINESIUS aus cod. Gothanus A 242 hrsg. von G. GOLDSCHMIDT (p. 387-98). This is a German dissertation on Greek alchemy dated Altenburg, 1634, by the famous philologist and epigraphist THOMAS REINES (Gotha, 1587—Leipzig, 1667).

II. Ueber das Verhältnis des Cod. Paris. 2327 (A) zum Cod. Marc. 299 (M). (Fortsetzung von Catalogue II, 341-358 von O. LAGERCRANTZ (p. 399-432). This concerns the treatise written by COMARIOS, philosopher and high priest to teach CLEOPATRA the sacred and divine art of producing the philosophical stone, first edited by RUELLE and BERTHELOT, and more recently by REITZENSTEIN: Zur Geschichte der Alchemie und Mystizismus (Nachrichten, Ges. d. Wiss., Göttingen, 1919, 1-37), whose interpretation is criticized. G. S.

Lippmann, Edmund O. von. Nachträge zur Geschichte des Wismuts. *Chemiker-Zeitung*, 57, 4, 1933. ISIS

Ruska, Julius. Turba philosophorum. Ein Beitrag zur Geschichte der Alchemie. X+368 p., 1 pl. (*Quellen und Studien zur Geschichte der Naturwissenschaften und der Medizin*, 1). Berlin, SPRINGER, 1931. ISIS

Reviewed by MAX MEYERHOF, *OLZ*, 36, 12-15, 1933.

Willstätter, Richard. Zur Feier seines sechzigsten Geburtstages. *Die Naturwissenschaften*, 20, 599 ff., 1932. ISIS

26. — TECHNOLOGY

(*For mining, see* 32. *geology*; *for industrial chemistry, see* 25. *chemistry*. *See also Arts and Crafts under* 45)

Feldhaus, Franz Maria; **Siegfried, Karl.** Das blaue Badewannenbuch. 93 p., 48 fig. Schwarzenberg i. Sa., KRAUSS, 1932. ISIS

FELDHAUS schildert die Entwicklung der Badewanne von der römischen Zeit bis zur Gegenwart und bringt dazu 48 Abbildungen. SIEGFRIED schreibt über das Baden der Völker im Spiegel der Zeiten. F. M. F.

Feldhaus, F. M. Vom Dampfross zum Schnellwagen. 41 fig. Hannover, 1932. ISIS

Hier wird unter Beigabe von 99 Literaturstellen kritisch untersucht, wie der Schnellbahngedanke entstand. Es ist auffallend, wie lange die Entwicklung der Dampf-Eisenbahnen stillstand. Es wird nachgewiesen, dass FRANZ KRUCKENBERG der eigentliche Schöpfer des Schnellbahnwagens ist und dass die Ansprüche, die KURT WIESINGER öffentlich stellte, nicht begründet sind. F. M. F.

Festschrift des Vereins Schweizerischer Centralheizungsindustrieller, 1906-1931, 195 p. ISIS

Neben wissenschaftlichen Arbeiten über Heizung von Räumen werden folgende illustrierte Beiträge gebracht : Feuerbecken, Hypokaustheizungen, Kanalheizungen, Steinofenheizungen, Rauch-Röhrenheizungen, Kamine, Kachelöfen, eiserne Ofen, Luftheizungen, Dampfheizungen, Warmwasserheizungen und Lüftungsanlagen. F. M. F.

Krause, Arthur. Wissen ist Macht. 3 vols. 3rd ed., figs., pl. Nordhausen, KILLINGER, 1933. ISIS

In diesem Werk bringt F. M. FELDHAUS mit KARL KOLL einen Abschnitt von 200 Seiten " Die Technik, ihr Werden und Wirken." Dazu gehören über 200 Abbildungen. Die Entwicklung der Technik, Kraft, Verkehr und die grossen Erfindungen werden kritisch behandelt. F. M. F.

Reeve, Sidney A. Ship evolution and social evolution. *Geographical Review*, 61-76, 9 fig., 1933. ISIS

Rouch, J. Un coup d'œil sur l'histoire de la navigation. *Revue générale des sciences*, 43, 599-612, 1932. ISIS

Ungerer, Alfred. Les horloges astronomiques et monumentales les plus remarquables de l'antiquité jusqu'à nos jours. Préface de E. ESCLANGON. 514 p., 458 illus. Paris, BERGER-LEVRAULT. ISIS

IV. — BIOLOGICAL SCIENCES
(knowledge of organic nature)

27. — BIOLOGY
(*generalities*, " *natural history* ")

Brown, W. Langdon. The history of the introduction of bio-chemistry into medicine. *Proceedings of the Royal Society of Medicine*, 25, 1046-54, 1932. ISIS

Chapman, A. Chaston. The fungi imperfecti, and a further plea for an institute of industrial micro-biology. *Journal of the Royal Microscopical Society*, 16 p., March, 1926. ISIS

Chapman, A. Chaston. The yeasts: a chapter in microscopical science. *Journal of the Royal Microscopical Society*, 16 p., March, 1926. ISIS

Neuburger, Max. Early phases of microbiology. *Medical Life*, 39, 710-16, 1932. ISIS

Opuscula selecta Neerlandicorum de arte medica. Fasciculus undecimus quem curatores miscellaneorum quae vocantur *Nederlandsch Tijdschrift voor Geneeskunde* collegerunt et ediderunt. 359 p., pl. Amstelodami, Sumptibus Societatis, 1932. ISIS

The very valuable volumes of this collection have been reviewed in *Isis* as they appeared. The present, eleventh, one is devoted to the history of vitalism. It contains three vitalistic writings which are registered in this bibliography at their respective places: VAN HELMONT (first half of the seventeenth century), GAUBIUS (first half of the eighteenth century), SCHROEDER VAN DER KOLK (first half of the nineteenth century). Their significance is explained in an introduction (31 p.) by Dr. F. M. G. DE FEYFER, outlining the whole history of vitalism. G. S.

28. — BOTANY

(*Agronomy, phytopathology, palaeobotany*)

Browne, C. A. The spontaneous heating and ignition of hay and other agricultural products. *Science*, 77, 223-29, 1933. ISIS

Includes historical notes. "The original observation of LANMARCK in 1777 that the fleshy spike or spadix of the flowers of *Arum maculatum* at a certain stage of growth was perceptibly warm to the touch first called the attention of scientific men to the heat-producing power of growing plants.", etc.

Nelmes, Ernest; Cuthbertson, William. CURTIS's Botanical Magazine dedications 1827-1927; portraits and biographical notes. XXI + 400 p., 100 pl. London, QUARITCH, 1931. ISIS

Reviewed by T. A. S., *Nature*, 130, 830-31, 1932.

Post, George E. Flora of Syria, Palestine and Sinai: a handbook of the flowering plants and ferns, native and naturalized from the Taurus to Ras Muhammad and from the Mediterranean Sea to the Syrian Desert. Second edition, extensively revised and enlarged by JOHN EDWARD DINSMORE. XLIV + 639 p. (*American University of Beirut: Publications of the Faculty of Arts and Sciences:* Natural Science series, no. 1.) Beirut, American Press, 1932. ISIS

Setchell, William Albert. Aboriginal tobaccos. *American Anthropologist*, 23, 397-414, map, 1921. ISIS

" According to DE CANDOLLE in his *Orgin of Cultivated Plants*, somewhat, over forty of the plants now generally cultivated came from the Americas, some of them having been introduced into Europe very soon after the discovery of the ' new continent ' by COLUMBUS. This has been regarded as being true particularly of maize, potatoes, and tobacco. There have not been wanting claims as to other origins for many of these supposedly American cultivated plants and the tobaccos have frequently been under suspicion. The most careful investigations, however, have tended only to confirm the idea of the non-existence of any species of tobacco used for smoking, snuffing, or chewing outside the confines of the American continents." The author examines the evidence from the botanical standpoint. G. S.

Setchell, W. A. History of botany (Botany 150). List of original sources from DIOSCORIDES to JOHN RAY. Berkeley, Cal., no date. ISIS

List of the fundamental botanical books available in the Library of the University of California with their shelfnumbers, for the convenience of students taking Botany 150. G. S.

Setchell, W. A. History of botany. Tentative outline to be critically examined, criticized and verified or amended. (Course at the University of California, Botany 150). 34 mimeographed sheets. Berkeley, Cal. Revised July 1930. ISIS

Very interesting syllabus of this course with chronological summaries and bibliographies. G. S.

Setchell, William Albert. Some early algal confusions. *University of California Publications in Botany*, 16, 351-66, pl. 31, Berkeley, California, 1931. ISIS

Includes valuable notes on the early algologists. G. S.

Watkins, A. E. The origin of cultivated plants. *Antiquity*, 7, 73-80, 1 pl., 1 map, 1933. ISIS

" In studying this problem three methods have been used : the linguistic and historical; the examination of seeds found in prehistoric remains; and the search for regions where the wild relatives of modern crops occur. VAVILOV has developed a new method, which depends essentially upon collecting the varieties of each crop and finding regularities in their geographical distribution. For two reasons his conclusions can best be illustrated by wheat. First, because this is one of the most important crops, which he has studied in great detail. Secondly ,because much has been learned about the origins and relationships of the various forms from genetical and cytological research —that is to say from their behaviour when crossed and the way in which their differences are inherited." " VAVILOV has clearly shown that the varieties of cultivated plants have an orderly distribution; that regularity prevails where chaos might have been anticipated. In the simplest case each species has a definite centre, believed to be the centre of origin, in which it is most

diverse; and each becomes progressively more uniform as this centre is left behind. In other instances the distribution is less simple, but more or less plausible reasons for the complications have been given. Furthermore, the species themselves appear to have come from a small number of limited areas; and these, it is suggested, are primary world-centres of agriculture. It is possible that some of VAVILOV's conclusions will, in course of time, need modifying. But in general they agree well with the simple series of regularities he found, and no theory of the origin and spread of human cultures can safely ignore them."

Wildeman, Emile de. La botanique congolaise depuis 1830. *Comptes rendus du Congrès national des Sciences*, 711-14, Bruxelles, 1930. ISIS

29. — ZOOLOGY

Boubier, Maurice. L'évolution de l'ornithologie. Nouvelle édition. 308 p. Paris, ALCAN, 1932. ISIS

Cette « nouvelle édition » paraît être tout simplement une réimpression de la première édition de 1925 qui fut dûment analysée dans *Isis* (8, 515-17). Il n'y a même pas de nouvelle préface; quelques pages prises au hasard sont absolument identiques; le nombre de pages est le même. Pour un autre ouvrage du même auteur sur « Les oiseaux. L'ornithologie et ses bases scientifiques » (Paris 1926) voir *Isis*, 9, 198. G. S.

Cuénot, Lucien. La genèse des espèces animales. Troisième édition entièrement refondue. VIII+822 p., 162 fig. Paris, ALCAN, 1932. ISIS

Cette troisième édition d'un traité qui contient plus que ne promet son titre, diffère profondément de l'édition précédente (*Isis*, 6, 646), non seulement par l'importance de son texte, qui est passé de 558 p. à 822, mais par l'ordre suivi par l'auteur, la mise au courant et la refonte de la plupart des chapitres. Seule, la première partie, traitant de l'histoire du transformisme, est peu remaniée. La deuxième partie répond par la négative à cette question : le transformisme n'est-il qu'une hypothèse? La troisième partie est l'étude des facteurs connus de l'évolution : variation et hérédité, action des milieux, concurrence pour la vie, sélection; il faut, selon CUÉNOT, leur ajouter des facteurs « inconnus » qui rendraient « compte de ce qu'il y a d'invention, de direction, d'intentionnel », et aussi parfois d'absurde dans la vie. Dans la quatrième partie, CUÉNOT tente d'élucider les trois grandes questions biologiques : *a*) conditions de formation de nouvelles espèces; *b*) origine des adaptations ou peuplement des places vides; *c*) orthogenèses ou séries évolutives, qu'elles soient progressives ou régressives. Enfin, après avoir consacré une centaine de pages à « quelques problèmes transformistes », tels que l'atrophie des ailes chez les insectes qui ne volent plus, les questions que posent la coloration, le mimétisme, l'origine de l'homme, CUÉNOT étudie dans la sixième partie le peuplement de la terre, et clot son livre par une étude de géographie zoologique. Chaque chapitre est suivi d'une bibliographie sommaire excellente. L. G.

Howard, L. O. Fighting the insects. The story of an entomologist. Telling of the life and experiences of the writer. XVII+333 p. New York, MACMILLAN, 1933 ($ 2.50). ISIS

This is a gossipy and reminiscent account of the development of applied entomology in the United States, where it largely originated. It relates to the period in which it flourished most luxuriantly under the leadership of the author. This autobiography throws sidelights on the characteristics and work of many leading American men of science, especially at Washington, and in the American Association for the Advancement of Science, of which the author was for many years the Permanent Secretary. Dr. HOWARD had a directing and leading part in the introduction of predatory insects and of parasites for the biological control of the insect enemies of agriculture and horticulture. He is likewise responsible for the introduction of larvacides in mosquito control for the suppression of malaria and yellow fever. He early called attention to the significance of the " typhoid fly " and devised measures for the reduction of this pestiferous insect. His international contacts were extensive and influential. To him more than to any other biologist is due the development of the extensive and well-organized state and federal bureaus and scientific staffs of economic, sanitary, and field entomologists who are now carrying on the war against the menace of the insect world. C. A. K.

V. — SCIENCES OF THE EARTH

(Implying knowledge of both organic and inorganic nature)

31. — GEOGRAPHY AND OCEANOGRAPHY

Bretz, J. Harlen. The Grand Coulee. X+89 p., 53 fig., 1 map, 8 stereoscopic views. (*American Geographical Society*, special publication no. 15). New York, American Geographical Society, 1932. ISIS

Description and discussion of the Grand Coulee, a streamless canyon fifty miles long, nearly a thousand feet deep and about a mile in minimum width, crossing the Columbia Plateau in Washington. History of the earlier interpretations, 1835, etc. (p. 39-43). G. S.

Goblet, Y. M. La géographie historique et l'histoire de la géographie au III^e^ congrès de l'Union géographique internationale (Paris, sept. 1931). *Rev. historique*, 170, 32-45, 1932. ISIS

Miller, O. M. An experimental air navigation map. *Geographical Review*, 48-60, 1 map, 1933. ISIS

With separate map and outline of the history of air map research. " The first time that the need for an air map was discussed in print was as far back as 1888. Lieutenant Colonel H. MOEDEBECK in the *Zeitschrift für Luftschiffahrt* made the suggestion, and, as far as can be ascertained, the first

attempts to construct a map exclusively for flying purposes were made in France in 1911 " (p. 56). List of air maps. G. S.

32. — GEOLOGY, MINERALOGY, PALAEONTOLOGY, MINING

(For palaeobotany, palaeozoology and palaeoanthropology, see respectively 28. *botany,* 29. *zoology and* 39. *prehistory)*

Denayer, Marcel. Les sciences minérales en Belgique de 1830 à 1930. *Livre d'or du Centenaire de l'Indépendance belge.* LECLERCQ, DE RIDDER, et DE HAAS. p. 248-51. Bruxelles-Anvers, 1931. ISIS

Wilson, Sir **Arnold T.** Earthquakes in Persia. *Bull. of the School of Oriental Studies,* 6, 103-31, 1 pl., 1930. ISIS

Including list of earthquakes from 550 A.D. to 1930, and map. G. S.

VI. — ANTHROPOLOGICAL AND HISTORICAL SCIENCES

(Knowledge of man, past and present)

34. — ANATOMY

Bilikiewicz, Tadeusz. Die Embryologie im Zeitalter des Barock und des Rokoko. 184 p., 19 Abbild. *(Arbeiten des Instituts f. Geschichte d. Medizin an der Univ. Leipzig,* Bd. 2). Leipzig, THIEME, 1932. ISIS

Abriss der Geschichte der vor-Harvey'schen Embryologie. I. Die Entwicklungslehre des Barock. 1. Gründung der dynamistischen Entwicklungslehre in der Mitte des 17. Jahrhunderts : W. HARVEY, R. DE GRAAF, W. NEEDHAM; 2. Der mechanistische Funktionalismus in der Embryologie des 17. Jahrhunderts : R. DESCARTES, G. A. BORELLI, T. WILLIS; 3. Die Umstürzung der Urzeugungstheorie und das Erscheinen der ersten präformationistischen Theorien : F. REDI, M. MALPIGHI, J. SWAMMERDAM, N. MALEBRANCHE, A. VAN LEEUWENHOEK. II. Übergang vom Barock zum Rokoko; 4. Die Ovisten und die Animalkulisten als erste Künder der Aufklärungsepoche : *a*) Animalkulisten : N. HARTSOEKER, G. W. LEIBNIZ, N. ANDRY; *b*) Ovisten : A. VALLISNIERI, L. BOURGUET; 5. Panspermatisten; 6. Die Reaktion des Vitalismus gegen den Mechanismus und des Epigenetismus gegen den Evolutionismus : G. E. STAHL; 7. Die Entdeckung des Geschlechts bei den Pflanzen: R. J. CAMERARIUS; 8. Ein Blick auf die Problematik der Embryologie um die Wende des 17. und 18. Jahrhunderts. III. Die Entwicklungslehre des Rokoko; 9. Die Wiedergeburt des Epigenetismus : P. L. M. DE MAUPERTUIS, R. A. F. DE RÉAUMUR, J. T. NEEDHAM, G. L. L. DE BUFFON; 10. Die zeitgenössische Kritik an BUFFON und NEEDHAM; 11. Der Aufschwung des Aufklärungsevolutionismus in der Form eines Rokoko-Ovismus : A. v. HALLER, C. BONNET, L. SPALLANZANI, J. G. D'AGOTY; 12. Aus dem Grenzgebiete der Embryologie und der Geburtshilfe : W. HUNTER und andere;

13. Die Erschütterung des Evolutionismus und Mechanismus; Die siegreiche Entwicklung des Epigenetismus und Vitalismus : E. L. M. PATRIN, J. F. BLUMENBACH, C. F. WOLFF. Ausblick auf die Zukunft. L. G.

37. — PSYCHOLOGY
(*human and comparative*)

Achille-Delmas, F. Psychologie pathologique du suicide. XII+238 p. (*Biblioth. de philosophie contempor.*) Paris, ALCAN, 1932. ISIS

Cet ouvrage du psychiatre F. ACHILLE-DELMAS se compose de deux parties. L'auteur s'élève d'abord contre la thèse mise en avant par E. DURKHEIM (1858-1917) (*Le suicide*, ALCAN, 1898), et reprise et amplifiée récemment par M. HALBWACHS (*Les causes du suicide*, ALCAN, 1930) selon laquelle le suicide aurait des causes essentiellement sociologiques, et ce lui est occasion d'une critique serrée et fine de l'utilisation des statistiques. Il expose ensuite, fixant les frontières exactes du suicide, éliminant les pseudo-suicides, et donnant du suicide vrai une définition plus précise que celle de DURKHEIM, la théorie psycho-pathologique du suicide, celui-ci se rencontrant surtout chez les cyclothymiques, chez les déprimés constitutionnels et chez les hyperémotifs. A propos du suicide des stoïciens, il montre comment s'est établie la légende du beau suicide, et examinant assez longuement le cas illustre de CATON D'UTIQUE, y met en évidence le rôle de l'hérédité cyclothymique. Bien des lecteurs admettront difficilement certaine appréciation portée sur MONTAIGNE (p. 175). Les références bibliographiques sont parfois bien insuffisantes (p. ex. pp. 156 et 183). L. G.

Langfeld, Herbert S. The historical development of response psychology. *Science*, 77, 243-50, 1933. ISIS

Vialle, Louis. Le désir du néant. Contribution à la psychologie du divertissement (*Bibl. de philosophie contemporaine*). 748 p. Paris, ALCAN, 1933. ISIS

L'auteur de ce livre, dont le titre peut paraître à priori étrange s'est proposé d'apporter « une contribution à la psychologie du divertissement, au sens pascalien du terme ». Il a voulu « montrer les subterfuges moraux les plus remarquables par lesquels l'homme parvient à se ' divertir ' de certaines pensées dont l'obsession est dangereuse pour la vie », subterfuges qui « consistent tous, en définitive, à réduire le plus possible la conscience de la personnalité, ou, si l'on veut, de ses inévitables limites »; d'où le nom de rédemption, suivi d'un qualificatif, qu'il donne à chacune des parties de son livre. Sous le titre : la rédemption religieuse, il étudie la personnalité de STE THÉRÈSE, celle de SAINT JEAN DE LA CROIX et celle de PASCAL. SCHOPENHAUER « le type le plus remarquable de ces philosophes qui engagent l'individu à se dissoudre dans l'univers », mais qui « n'a point voulu se dissimuler que le terme de nos aspirations, s'il pouvait être atteint, ne serait pas une éternité de vie débordante, mais le néant », fait l'objet d'une étude présentée sous le titre : la rédemption métaphysique (pp. 247-420). Le cas d'AUGUSTE COMTE, étudié plus longuement (pp. 439-649) comme la rédemption positiviste, est caractéristique de ceux

qui ont « aimé, adoré l'Humanité comme un succédané du divin ou de l'absolu ». Enfin, la rédemption individualiste, qui peut se revêtir de formes très variées, est présentée avec les exemples de E. P. DE SÉNANCOUR (dont le nom, on ne sait pourquoi, n'est pas prononcé dans les pages qui lui sont consacrées), de A. DE VIGNY, de H. F. AMIEL, et surtout de MAX STIRNER. En même temps que ce livre, l'auteur en fait paraître un autre : *Détresses de Nietzsche* (voir cette même bibliographie, XIX (2) E), qui peut être considéré comme un prolongement de son étude principale, mais qui ne pouvait y être intégré, le cas de NIETZSCHE chevauchant en quelque sorte les quatre parties en lesquelles elle est agencée. L. G.

39. — PREHISTORY

Davies, O. Bronze age mining round the Aegean. *Nature*, 130, 985-87, 1932. ISIS

Denninger, Henri Stearns. Paleopathological evidence of PAGET's disease. *Annals of Medical History*, 5, 73-81, 7 fig., 1933. ISIS

40. — ETHNOLOGY
(*Primitive and popular science*)

Eilhauer. Ein aztekischer Kalenderstein. *Das Weltall*, 30, 158-59, 1931. ISIS

Fettweis, Ewald. Ueber das Verhältnis des mathematischen Denkens zum mystischen Denken auf niederen Kulturstufen. *Archeion*, 14, 207-20, 1932. ISIS

Lévy-Bruhl, Lucien. Le surnaturel et la nature dans la mentalité primitive. XL+526 p. Paris, ALCAN, 1931. ISIS

Compte-rendu de CHARLES BLONDEL, *R. de métaphysique et de morale*, 39, 539-67, 1932.

Ludendorff, H. Untersuchungen zur Astronomie der Maya. Nr. 1 : Über die Entstehung der Tzolkin-Periode im Kalender der Maya. Nr. 2 : Über die Reduktion der Maya-Datierungen auf unsere Zeitrechnung. Nr. 3 : Die astronomische Bedeutung der Seiten 51 und 52 des Dresdener Maya-Kodex. Nr. 4 : Das Mondalter in den Inschriften der Maya. Nr. 5 : Die Venustafel des Dresdener Kodex. *Sitzungsberichte der Preussischen Akademie der Wissenschaften*, phys.-math. Kl. 1930. V, 87-107 ; 1930. XVIII, 265-78 ; 1931. I, 8-19 ; 1931. III, 40-62 ; 1931. VIII, 134-42. ISIS

Reviewed by E. ZINNER, *Vierteljahrsschrift der Astronomischen Gesellschaft*, 67, 37-43, 1931. " Die sehr sorgfältigen und dankenswerten Untersuchungen ergeben die Zulässigkeit der SPINDENschen Festsetzung, ferner einen Einblick

in die Finsternis- und Mondrechnung der Maya und eine Erklärung der Verschiedenheit ihrer Kalender." G. S.

Marinus, Albert. La légende. *Folklore Brabançon*, nº 67, 52 p., Brussels, 1932. ISIS

Marinus, Albert. L'observation directe dans le folklore. *Folklore Brabançon*, nº 66, 11 p., Brussels, 1932. ISIS

Marinus, A. L'orientation nouvelle dans le folklore. *Folklore Brabançon*, nº 68, 18 p., Brussels, 1932. ISIS

Müller, Rolf. Die Intiwatana (Sonnenwarten) im alten Peru. *Baessler-Archiv*, 13, 176-87, 1929. ISIS

Nieuwenhuis, A. W. Urformen des naturwissenschaftlichen Denkens und der Naturauffassung auf dem amerikanischen Festlande. *Janus*, 36, 228-34, 251-64, 283-96, 318-26, 1932. ISIS

Ruhräh, John. Aztec methods in child-training. *Bulletin of the Institute of the History of Medicine*, The Johns Hopkins University, 1, 19-22, 4 pl., 1933. ISIS

Thompson, Stith. Motif-index of folk-literature. A classification of narrative elements in folk-tales, ballads, myths, fables, mediaeval romances, exempla, fabliaux, jest-books, and local legends. 432 p. (*Indiana University Studies*, 19, nos. 96, 97). Bloomington, 1932. ISIS

" The purpose of the present study has been to arrange in a single logical classification the elements which make up traditional narrative literature. Stories that have formed part of a tradition, whether oral or literary, find a place here. The folk-tale, the myth, the ballad, the fable, the mediaeval romance, the fabliau, the jest, the exemplum, and the local tradition have all been included, though some of these divisions have been only partially recorded."

Classifiaction : A. Creation, nature of the world; B. Animals, totemism; C. Tabu; D. Magic; E. Ideas about the dead; F. Marvels; G. Ogres, witches; H. Tests; J. Wisdom, cleverness, foolishness; K. Deception, etc. These chapters are divided into grand divisions, to each of which is assigned a hundred numbers. For example, B10-B19 : Mythical beasts, is subdivided as follows. B10. Generalities; B11. Dragon; B12. Basilisk; B13. Unicorn, etc. B11.1. Origin of the dragon; B11.1.1. Dragon from cock's egg; B11.2. Form of the dragon, etc.

The amount of material handled by the author is immense. The present volume contains chapters A to C. We look forward to the completion of this work which will be undoubtedly very useful, though its real value will only be determinable after long and repeated use.

This study is also issued as FF Communications no. 106, Helsinki, 1932. G. S.

Wright, Jonathan. Medicine of primitive man, XXI. *Medical Life*, 39, 616-28, 1932. ISIS

42. — ECONOMICS

(Economic doctrines and history, Commerce. Transportation and communications)

Econometrica. Journal of the Econometric Society. An international society for the advancement of economic theory in its relation to statistics and mathematics. Vol. 1, no. 1, January 1933. ISIS

Editor: RAGNAR FRISCH (Oslo); Associate editors: ALVIN H. HANSEN (Minneapolis), FREDERICK C. MILLS (New York City), HAROLD T. DAVIS (Bloomington, Indiana). Published quarterly for the Econometric Society by the George Banta Publishing Co., Menasha, Wisconsin. Subscription price $ 7.00 per annum.

43. — SOCIOLOGY, JURISPRUDENCE AND POSITIVE POLITY

Kirkpatrick, Edwin A. The sciences of man in the making. An orientation book. XVI+396 p. New York, HARCOURT, BRACE, 1932 ($ 4.00). ISIS

This book is a recent issue in the International Library of Psychology under the editorship of Mr. C. K. OGDEN of Magdalene College, Cambridge. Its motive is sociological. Its aim is to be a guide to some of the general truths regarding man and his place in nature, to illustrate methods of research currently employed in the various sciences of man, and to give a fairly clear concept of each of these sciences, of the methods by which they are being developed, and of their relationships to each other. The chapters deal with the nature and methods of science; man as an inhabitant of the earth; anthropology and ethnology; physiology and hygiene; eugenics and euthenics; economics; political science; general, individual, and social psychology; sociology; religion; morals; and ethical living. Significant results in each field are summarized and brief examples illustrating the methods being used in each field are quoted. Bibliographies accompany each chapter.

C. A. K.

44. — HISTORY OF CIVILIZATION

(General history, historical methods, biography and chronology)

Allen, W. E. D. A history of the Georgian people. From the beginning down to the Russian conquest in the nineteenth century. Introduction by Sir DENISON ROSS. XXIV+429 p. London, KEGAN PAUL, 1932. ISIS

(History). List of doctoral dissertations in history now in progress at the chief American universities, December, 1932. 64 p.

Washington, D.C., Department of Historical Research, Carnegie Institution, 1933. ISIS

Lüdtke, Gerhard ; Mackensen, Lutz. Deutscher Kulturatlas. 5 Bde. 500 Tf. Berlin, DE GRUYTER, 1932. ISIS

In diesem Werk wird die gesamte deutsche Kultur entweder auf Landkarten, oder graphisch, oder in Form von Tabellen und Bildertafeln dargestellt. Vorgeschichte, Geschichte, Siedlung, Wirtschaft, Verkehr, Religionsgeschichte, Recht, Sprache, Literaturgeschichte, Bildungsgeschichte, Philosophie, Technik, Handwerk, Kunst und Musik werden von Fachleuten behandelt. Der erste Band geht von den ältesten Zeiten bis zum Jahr 1000, der zweite Band reicht bis zur Reformation (1517), der dritte Band geht bis zum Rokoko (1750), der vierte bis zu BISMARCK (1870) und der fünfte bis in die neue Zeit. Die Technik ist von F. M. FELDHAUS auf 30 Tafeln behandelt. Der erste Band enthält die Technik der Karolinger, der zweite eine Tafel über den Einfluss von Schiesspulver und Geschütz, sowie über das Handwerk des Mittelalters. Jeder der Bände 2-5 enthält 1 Tafel über Waffen, Verkehr, Kraftmaschinen und 1 Tabelle der technischen Kultur und der grossen Erfindungen. Die Tafel " Verkehr " hat sich bis zum 5 Band in mehrere Unterabteilungen aufgeteilt : 2 Tafeln Landverkehr, und je 1 Tafel Verkehr auf dem Wasser, Luftverkehr und Nachrichtenverkehr. Der 5. Band bringt von FELDHAUS ferner 1 Tafel mit dem Vergleich der Technik im Wohnhaus in den Jahren 1830 und 1930, ebenso 1 Tafel " Mensch und Technik," in der gezeigt wird, wie der heutige Mensch von der Technik abhängig ist. F. M. F.

Reparaz, Gonzalo de. Historia de la colonización. I. 468 p., 16 pl., 105 fig. Barcelona, Editorial Labor, 1933. ISIS

Another manual of the excellent collection Labor which is (or will be) to the Spanish world what the collection Hoepli is to the Italian. This history of colonization is beautifully illustrated (16 pl., 105 fig., colored maps). It is divided into two almost equal parts : 1. From the beginnings to the fall of the Roman Empire; 2. To the constitution of the English Empire. A critical analysis would be out of place here, but our readers do already know the author (See *Isis*, 15, 306; 16, 558). G. S.

48. — HISTORY OF PHILOSOPHY

(See also above 18. *Philosophy of science)*

Wahl, Jean. Vers le concret. Etudes d'histoire de la philosophie contemporaine, 272 p., Paris, VRIN, 1932. ISIS

L'auteur a groupé sous ce titre, les réunissant par une préface parue aux *Recherches philosophiques* (I, 1-20, 1932), trois études antérieurement publiées, les deux premières dans la *Revue philosophique*, la troisième à la *Revue de métaphysique et de morale* : WILLIAM JAMES d'après sa correspondance (The letters of WILLIAM JAMES, 2 vol., London, LONGMANS, 1920. Des extraits de cette correspondance ont été traduits en français par F. DELATTRE et M. BRETON, Paris, PAYOT, 1924. WILLIAM JAMES, 1842-1930); La philosophie

spéculative de WHITEHEAD (d'après l'ensemble de son œuvre philosophique parue avant 1929; l'article original est de 1931); Le Journal métaphysique de GABRIEL MARCEL (Paris, GALLIMARD, 1927; cette dernière étude fait naturellement des allusions nombreuses à l'œuvre dramatique de G. MARCEL, dont on vient encore en cette fin d'automne 1932, de représenter une pièce : Le mort de demain, qui est une condamnation féroce de l'aberration de 1914). L. G.

VII. — MEDICINE

50. — HISTORY, ORGANIZATION, AND PHILOSOPHY OF MEDICINE

Andel, M. A. van. De aderlating in theorie en practijk. *Bijdragen tot de geschiedenis der geneeskunde*, 12, 224-39, 4 fig., 1932 ; 13, 61-67, 3 pl., 1933. ISIS

Theory and practice of bloodletting. G. S.

Aperlo, G. Medaglie coniate in onore di anatomici, medici, chirurghi, specialisti italiani del secolo XVIII, XIX e XX. *Riv. di storia d. sc. med. e natur.*, 23, 117-128, 174-76, 1932. ISIS

Médailles frappées en l'honneur de ENRICO BOTTINI (1838-1903), MAURIZIO BUFALINI (1787-1875), CESARE CATTANEO (1871-1930), ANTONIO COCCHI (1695-1758), VINCENZO CHIÒ (....-1846), CARLO LUIGI FARINI (1812-1866), PETER JOH. FRANK (1745-1821) et son fils JOSEPH FRANK (1771-1842), LUIGI GALVANI (1737-1798) (2 médailles), CAMILLO GOLGI (1843-1926), EDOARDO GRANDI (1849-1912), GIUSEPPE LAPPONI (1851-1906) et GAETANO MAZZONI (1854-1922), ANTONIO CARLO LORENZUTI (1806-1867); MARCELLO MALPIGHI (1628-1694); LUIGI MANGIAGALLI (1850-1927); CARLO MONDINI (1729-1805); FRANCESCO MONDINI (1786-1844). L. G.

Casoli, Vincenzo. Fra i monaci. Rievocazioni d'igiene e di medicina cenobitica. *Rivista di storia delle scienze mediche e naturali*, 23, 241-57, 1932. ISIS

Coulter, John S. Physical therapy. XVII+142 p., 15 illus. (Vol. VII in the Clio Medica series). New York, HOEBER, 1932. ISIS

One of the most active recent " specialties " in the overworked specialism of medical practice is physical therapy. Thus the medical profession makes up for its long neglect of physical methods of treatment opportunely usurped by certain cultists who with inadequate training in the fundamentals of medicine have exploited the general ignorance of the public regarding disease. Dr. COULTER's effort is thus most timely in affording a brief but helpful historical survey of the scientific background of modern physical therapy, as well as the blind alleys into which work in this field has sometimes led in the past. Dr. COULTER divides his presentation as follows : I. Physical therapy from ancient times to the Renaissance; II. Massage and exercice;

III. Water; IV. Electricity; V. Radiant energy. There is a fair bibliography, good index, and the illustrations are well chosen. C. D. L.

Diamare, V. Documenti cassinesi di medici del XVII e XVIII secolo. *Riv. di storia d. sc. med. e natur.*, 23, 49-67, 97-108, 1932. ISIS

I. Delle "separationi." Lettera del Dr. GIUSEPPE ZAMBECCARI, prof. di anatomia in Pisa (16..); 2. *Methodus samandi podagram.* Lettera di IOHANNIS IACOBUS FERIA, medicus Lovaniensis (1664); 3. Un consulto nelle prima decade del 800 di DOMENICO COTUGNO e BRUNO AMANTEA (1810), e uno di altri, forse posteriori, sulla malatia del Sign. P. X. e qualche rilievo storico; 4. Il rapporto sulla malattia e lo stato mentale del Principe Ereditario Infante D. FILIPPO Primogenito di CARLO III, a firma di FRANCESCO SERAO (1759).

Diepgen, Paul. Die Lehre von der Konstitution in der vitalistischen Medizin. *Klinische Wochenschrift*, 12, 30-32, 1933. ISIS

Garrison, Fielding H. Geomedicine : a science in gestation. *Bulletin of the Institute of the History of Medicine*, The Johns Hopkins University, 1, 2-9, 1933. ISIS

Gemayel, Amin. L'hygiène et la médecine à travers la Bible. Préface du Prof. ACHARD. 296 p., 10 pl. Paris, GEUTHNER, 1932. (60 frs.) ISIS

L'auteur a lu attentivement la Bible entière et l'a annotée du point de vue médical. Sa qualité de Syrien lui a permis d'identifier des faits et des usages qui peuvent encore être observés aujourd'hui. D'autre part il ne paraît pas avoir tenu compte des travaux antérieurs sur le sujet, — travaux plus nombreux et plus approfondis qu'il ne se l'imagine. Les livres de la Bible sont considérés un à un, et cette analyse est suivie d'un index médical synoptique qui augmente de beaucoup la valeur de l'ouvrage. G. S.

Harris, Henry. California's medical story. With an introduction by CHARLES SINGER. San Francisco, STACEY, 1932. ISIS

Reviewed in *Annals of Medical History*, 4, 594, 1932.

Hurd-Mead, Kate Campbell. An introduction to the history of women in medicine. 1. Medical women before Christianity. *Annals of Medical History*, 5, 1-27, 16 fig., 1933. ISIS

Jegel, August. Nürnberger Gesundheitsfürsorge, vor allem während des 16. und 17. Jahrhunderts. *Sudhoffs Archiv für Geschichte der Medizin*, 26, 1-29, 1933. ISIS

Macmichael, William. The gold-headed cane. Edited with explanatory and illustrative notes and an essay on WILLIAM MACMICHAEL, M.D., his life, his works, and his editors, by HERBERT SPENCER

ROBINSON. Containing the original illustrations of the 1828 edition and hitherto unpublished portraits of the MACMICHAEL family and a reproduction of WILLIAM MACMICHAEL's handwriting. XXXI + 223 p., 3 port., facs., illus. New York, Froben Press, 1932 ($ 3.50).

ISIS

The readers of *Isis* need not be explained the significance of this classic of medico-historical literature. It will suffice to indicate the features of this new sixth edition, not to be found in other editions or elsewhere :

" (1) A portrait of WILLIAM MACMICHAEL, of his wife, MARY JANE FREER, and of his only child, MARY JANE (MACMICHAEL) CHEESE.

" (2) Interesting specimens of MACMICHAEL's handwriting, consisting of pages from his private notebook.

" (3) A biographical essay on MACMICHAEL that is, in view of our knowledge and the existing material, as complete as possible.

" (4) An account of MACMICHAEL's other works, with full bibliographical descriptions."

This is a very handsome volume, which would be an excellent medico-historical introduction for a young doctor. The new editor, HERBERT SPENCER ROBINSON, has added abundant notes. The first and second editions were published by JOHN MURRAY, 1827 and 1828; the third, prepared by WILLIAM MUNK, was published by LONGMANS, GREEN, 1884; the fourth edition, by FRANCIS R. PACKARD with a preface by Sir WILLIAM OSLER, was published by HOEBER, New York, 1915 (this being the first American edition); the fifth by GEORGE C. PEACHEY, appeared in London, 1923; and this is the sixth and latest, but in all probability not the last. G. S.

(Medicine, IX Congress of the history of). Compte rendu du IX[e] Congrès international d'histoire de la médecine à Bucarest, 10-18 septembre 1932. By LAIGNEL-LAVASTINE, *Bull. de la société franç. d'histoire de la médecine*, 26, 442-61, 1932. ISIS

(Medicine, IX Congress of the history of). Impressioni sommarie del IX Congresso Internazionale di storia della medicina (Bucarest 10-18 Settembre 1932). By D. GIORDANO. *Rivista di storia delle scienze med. e natur.*, 23, 224-35, 1932. ISIS

Neuburger, Max. The doctrine of the natural constitution. *Medical Life*, 39, 698-706, 1932. ISIS

Neuburger, Max. Forerunners of serum therapy. *Medical Life*, 39, 707-10, 1932. ISIS

Neuburger, Max. Resumption of discredited methods of treatment. *Medical Life*, 39, 694-98, 1932. ISIS

Neuburger, Max. Something about organotherapy. *Medical Life*, 39, 693-94, 1932. ISIS

Neuburger, Max. Vis medicatrix naturae. *Medical Life*, 39, 657-92, 1932. ISIS

Robinson, Victor. Syllabus of medical history. 110 p., 15 pl., 6 facs., frontispiece. New York, Froben Press, 1933 ($ 1.). ISIS

The present volume will give students some idea of the purpose, contents and methods of medical history. It may provide the kind of initiation which many need. A colored frontispiece representing IMHOTEP will make them realize at once the hoary antiquity of their profession. Questions and answers relative to fifty selected topics of medical history are followed by a specimen essay on the great French neurologist, G. B. A. DUCHENNE of Boulogne (1806-75), a collection of 16 plates illustrating primitive and Egyptian medicine, a specimen chronology (on goiter), a chapter by CHARLES PERRY FISHER on the photostat and its use to students of medical history, and finally a photostatic reproduction of the section on asthma in JACOBUS SYLVIUS' *Morborum internorum* etc. (Paris, 1545). G. S.

Steinmetz, H. C. Medieval treatment in modern practice. *Medical Life*, 39, 629-30, 1932. ISIS

Apropos of the study of Filipino medicine by the late Dr. T. H. PARDO DE TAVERA posthumously translated c. 1930 by A. W. PRAUTCH. G. S.

51. — EPIDEMIOLOGY. HISTORY OF SPECIAL DISEASES. PUBLIC HEALTH AND SOCIAL MEDICINE

Annuaire sanitaire international 1930 (vol. 6). Rapports (avec statistiques démographiques et sanitaires) sur les progrès réalisés dans le domaine de l'hygiène publique en trente-quatre pays et colonies au cours de l'année 1929. (*Public. de la Société des Nations*, 1932, III, 2). 1115 p. Paris, GAMBER, 1933. ISIS

Castiglioni, Arturo. History of tuberculosis. Translated from the Italian by EMILIE RECHT. *Medical Life*, 40, 5-58, illus., facs., 63-96, port., 1933. ISIS

Contents : 1. Tuberculosis in classical antiquity. 2. The scholastic period. The Arabic school. Salerno. Treatment of scrofula. The king's evil. 3. Doctrine of contagion. Pathologico-anatomical conception from the Renaissance to the close of the 17th century. Anti-tuberculous legislation in the Italian states. 4. Evolution of clinical conception on the basis of pathological anatomy. The unitarian theory of BAYLE and LAENNEC. The dualistic theory of VIRCHOW.

Goldstein, Hyman I. Early references to anemia. *Medical Life*, 39, 646-47, 1932. ISIS

Harrison, Forrest M. Psychiatry in historical retrospect. *Annals of Medical History*, 4, 565-74, 1932 ; 5, 85-95, 1933. ISIS

Lint, J. G. de. De ontdekking van den parasitairen oorsprong der scabies. *Bijdragen tot de geschiedenis der geneeskunde*, 13, 27-28, 1933. ISIS

Sigerist, Henry E. The historical development of the pathology and therapy of cancer. *Bulletin of the New York Academy of Medicine*, 8, 642-53, 1932. ISIS

Sigerist, Henry E. Problems of historical-geographical pathology. *Bulletin of the Institute of the History of Medicine*, The Johns Hopkins Univeristy, 1, 10-18, 1933. ISIS

" The history and the geography of disease are inseparable themes. Historical-geographical studies in pathology can be of great importance for many investigations. Good work is going forward on these subjects all over the world, but it is scattered and not easily accessible. Therefore it seems to me opportune to encourage and centralize these studies by : (1) Founding an international journal devoted to historical-geographical pathology, giving historical as well as modern geographical studies, and a complete bibliography of the subject. (2) To begin a series of monographs on the history and geography of the different diseases, meant to replace the book of AUGUST HIRSCH. (3) To publish at the same time an Atlas showing geographically the distribution of diseases in time and space."

52. — HISTORY OF HOSPITALS, OF MEDICAL TEACHING, AND OF THE MEDICAL PROFESSION.

Chevki Osman. Turk Tababet Tarini (Histoire de la pratique médicale en Turquie). 236 p. Istanbul, Imprimerie Nationale, 1925. ISIS

Reviewed by A. ADNAN, *Archeion*, 14, 335-37, 1932.

Doninck, A. van. Gezinsverpleging te Gheel. Het vraagstuk der infirmerie. *Bijdragen tot de geschiedenis der geneeskunde*, 13, 53-60, 1933. ISIS

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53. — PHARMACY. PHARMACOLOGY. TOXICOLOGY.

Leclerc, Henri. Les vieilles panacées : la pimprenelle. *Janus*, 37, 19-30, 1933. ISIS

Rosemont, L. Reuter de. Histoire de la pharmacie à travers les âges. T. II. Du XVII[e] siècle à nos jours. 670 p., ill. Paris, PEYRONNET, 1931 (1932). ISIS

J'ai nettement dit (*Isis*, 19, 313-14) ce que je pensais de cette histoire de la pharmacie. Le second volume présente tous les défauts du premier : même confusion, même absence de références sérieuses; pas d'index.

L. G.

Rubertis, Achille de. Per la storia della gialappa. *Rivista di storia delle scienze mediche e naturali*, 23, 270-74, 1932. ISIS

History of the purgative root jalap. Name derived from that of its main source, the Mexican town of Jalapa. G. S.

VIII. — EDUCATION

(the methods of accumulating, imparting, and diffusing knowledge)

54. — EDUCATION

(*generalities, methods, colleges, universities*)

Kraentzel, F. Les savants étrangers en Belgique. Alumni (*Revue-Bulletin du Cercle des Alumni de la Fondation universitaire*), 4, 8-19, 1932. ISIS

De 1817 à 1830, sur les 84 professeurs des universités de Gand, Liége et Louvain, on comptait 38 étrangers, et, si l'on ne tient pas compte des facultés de médecine, 34 étrangers sur 56 professeurs, soit 60 % d'étrangers ! En 1843, dans les 2 universités de l'État : Gand et Liége, sur 83 professeurs ou agrégés, il y a 15 étrangers, soit 18 % ; à Bruxelles et Louvain, sur 88 professeurs, ou chargés de cours, il y a 23 étrangers, soit 26 %. Sur les 1600 professeurs et chargés de cours qui ont enseigné dans les universités belges de 1817 à 1931, 140 environ sont des étrangers, soit près de 9 %. Brèves indications sur les plus marquants de ces professeurs étrangers. Le Français RAOUL est l'auteur de l'épigramme suivante :

Dans son humilité profonde,
Notre modeste QUÉTELET
Se défend d'avoir fait le monde,
Convaincu qu'il l'aurait mieux fait.

J. P.

56. — BIBLIOGRAPHY

(*methods, libraries*)

Raney. M. Llewellyn. The university libraries. XV+250 p. (*The*

University of Chicago Survey, vol. 7). Chicago, University Press, 1933. ISIS

" ' The University of Chicago Survey ' will be complete in twelve volumes bound uniformly in maroon cloth stamped in gold, and boxed. The complete set will be published April 4, 1933, at $ 30.00." The present volume discusses the problem of university libraries in general, and more particularly the University of Chicago problem. Part. I. The organization of the libraries; Part II. The collections : departmental; Part III. The collections : general. It is very interesting to note that a special chapter of Part III is devoted to the History of Science (p. 225-28). It is stated that the University should contemplate the expenditure of $ 100.000 on this section alone. This chapter was contributed by Prof. J. W. THOMPSON. G. S.

Uhlendahl, Heinrich. Bibliotheken gestern und heute. Vortrag zur Einweihung der Bibliothek des Deutschen Museums in München am 7. Mai 1932. *Deutsches Museum, Abhandlungen und Berichte*, 4, 131-51, Berlin, 1932. ISIS

„Der Weg, den die kleine Schrift führt, ist lang, er wird jedoch nicht langweilig durch die gedrängte Darstellung und interessierende Schreibweise. Wir beginnen die Reise durch die Jahrtausende in der Tontafel-Bibliothek des Königs SARDANAPAL zu Ninive. Der Weg führt dann zu dem Papyrus Alexandrias und über das Pergament Pergamons zu den Codices des Mittelalters. Wir sehen, wie mit der Verbesserung der Vervielfältigungstechnik von der Tontafel bis zum Papier auch der Umfang der Bibliotheken, wenn auch nicht in gleichem Masse ihre Bedeutung, zunimmt. Erst die Erfindung des Buchdruckes gab die technische Voraussetzung für die Einrichtung grösserer öffentlicher Büchereien, und die Zeit der Reformation und der wissenschaftlichen Aufklärung schaffte das Bedürfnis nach ihrer Benutzung."

Critical bibliography no. 38, *Isis*, vol. XX. ISIS

This note is published at the end of our bibliography solely for the convenience of the scholars who cut out the whole or part of it, attach extracts to catalogue cards and classify them. By adding this note to the others they will be able to find out rapidly whether this particular bibliography has been analyzed or not. G. S.

59. — ERRATA. Series 28.

(*For previous errata, see* ISIS, XIX, 611, 1933)

Isis

Vol. 2, p. 267. Last note, read MENKE, not MENCKE.

Vol. 14, p. 487. Note VETTER, l. 3, read " tchèque," instead of " polonais."

Introduction to the History of Science

Vol. 2, p. 229, l. 6 from bottom, read 1905 for 1895.

p. 837, l. 26, read piedras for pietras.

p. 1220, under QUṢTĀ IBN LŪQĀ, read 171 instead of 172.

A few other misprints are not mentioned in these errata because they are too obvious to cause any error or confusion. I wish to express my thankfulness to the readers who take the trouble to make the above-mentioned corrections in their set of *Isis* and the *Introduction*. I would advise them, after having accomplished that little task, to write their initials near mine at the bottom of this note to indicate that these and the previous errata have been taken into account. G. S.

These and the previous errata have been corrected by...

Index of Authors Included in the Thirty-Eighth Bibliography

The Roman figures followed by (1) or (2) refer to the centurial classification (Part I). Thus, Gough, G. W., XVII (1) E means that a paper by Gough is listed under seventeenth century, first half, subdivision E.

The Arabic figures refer to the historical and to the systematic classification (Parts II and III) which are subdivided in sections numbered consecutively from 1 to 59. For instance, Chapman, A.C., 2, 27, indicates that papers by Chapman are listed in section 2 (Egypt), and in section 27 (biology).

April 1933.

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